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CHEMICAL & METALLURGICAL ENGINEERING

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AN EXCLUSIVE feature of *Chem & Met.'s* statistical service to its readers has been its annual estimates of the production and consumption of basic chemicals. These figures, derived from intimate contact with both producers and consumers and long experience in evaluating industrial trends, are published in the January issue several months in advance of the usually more accurate and official compilations of the Government or the trade associations.

As a measure of the reliability of these estimates, it is of interest to compare some of them with official statistics that are just now being issued by the governmental departments:

Production of Coal Products	Chem. & Met. Estimates Pub. Jan., 1928	Bureau of Mines Official Figures Released Apr. 20, 1928
Byproduct coke (millions of tons)	43.8	43.9
Bee-hive coke (millions of tons)	7.0	7.0
Oven capacity (millions of tons)	81 coal 56 coke	81 coal 56.6 coke
Tar (millions of gal.)	525	523
Crude light oils	162	163
NH_3, sulphate equivalent (thousand net tons)	688	683
Gas (billions of cu.ft.)	700	698
Difference	1 per cent or less	

NOT all of the estimates will come as near the mark as do these, but in the absence of official statistics, the reader may be assured that *Chem. & Met.* figures are reliable as well as useful and timely tools for the chemical engineering industries.

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CHEMICAL & METALLURGICAL ENGINEERING

H. C. PARMELEE
Editor

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An Anglo-American Stimulus to Technical Development

ANNOUNCEMENT by Sir Alfred Mond, chairman of Imperial Chemical Industries, Ltd., of the organization of the Finance Company of Great Britain and America, Ltd., on April 12, was received with favorable comment not only in chemical but also in financial circles in Great Britain. Three aspects of the new company and its announced purposes are of interest to chemical engineers. First, the great financial resources represented by the Chase National Bank of New York and Imperial Chemical Industries, Ltd. of England; second, the avowed purpose to foster new industries and support older ones that merit financial assistance; and third—a phase that will immediately appeal to every technical man—the recognition of the value of technical brains and ability by the directors who represent industries based on sound technology and relying upon research for their stability and progress.

FINANCIAL aspects of the new company are most impressive. Imperial Chemical Industries, the great English chemical combine with an issued capital of more than a quarter of a billion dollars, is the British participant. The Chase National Bank of New York with assets of a billion dollars is the American stockholder. These two organizations hold the entire capital stock of the new Finance Company (£2,040,000) in equal proportions. The directorate is headed by Sir Alfred Mond and includes Sir Harry McGowan, chairman Nobel Industries, Ltd.; Albert H. Wiggin, chairman Chase National Bank; Lord Reading, director I.C.I.; Lord Colwyn, director Dunlop Rubber Company; H. J. Mitchell, director I.C.I.; Henry Mond, Clarence Graff and James H. Gannon, the last two being joint managing directors of the Finance Company for the British and American interests respectively. Leaders of industry prominent on the American Committee are Alfred P. Sloan, Jr., president General Motors Corporation; John J. Raskob, vice-president E. I. duPont de Nemours & Company, Inc.; Matthew C. Brush, president American International Corporation; and Charles M. Schwab, chairman Bethlehem Steel Corporation.

SUCH financial backing speaks eloquently for unlimited possibilities in developing industries already established and in need of capital and expert advice, also for the development of new processes and products. As Sir Alfred Mond pointed out, I.C.I. is especially equipped, owing to its world wide interests and resources, its knowledge of industrial and financial matters, and its highly organized scientific and technical staff, to take the lead in this movement.

THIS liaison between financial and industrial brains is one of the most important characteristics of the new company, particularly with respect to highly technical industries. Apparently in England, as in America, it has sometimes been difficult to get financial assistance for promising ideas which, if intelligently investigated and developed, might grow into profitable industries. Not only have banks hitherto been unwilling to finance such ventures, due to lack of technical knowledge, but private capital was not forthcoming owing to the risk of failure and consequent loss. In this respect German industry has been more fortunate, for there the banks have had staffs of technical experts in commerce and manufacture. These facilities will now be available to British and American industry, and should prove a great stimulus to new developments.

H. C. Parmelee

London, May, 1928.

Straight Talk to American Industry

JUDGE Edwin B. Parker, chairman of the board of directors of the Chamber of Commerce of the United States, opened the recent annual meeting of that organization with a stirring address predicated on the statement that "The times demand straight thinking and frank speaking." His own vigorous denunciation of business "pirates" cleared the way for equally straight talk by some of the speakers who followed him. The result was that organized American industry had an unusual opportunity to size up its own shortcomings and to consider measures of correction and improvement.

In the seasoned experience of the distinguished jurist, private enterprise in this country is in less danger from radical agitators than from the few members within its own ranks who are faithless to their obligation, who break down public confidence, and who provoke governmental regulation. Business must purge itself, he said, of the small percentage of "pirates" which tends to bring the whole into disrepute. Enlightened self interest demands that organized business formulate a code of professional ethics that will bar from its ranks those who wilfully violate the fundamental principles of sound business.

Lewis E. Pierson, president of the Chamber, directed attention to the ever-present problem of balancing production and consumption. Industry "which has enlisted the aid of science and invention to perfect the efficiency of its industrial processes must now prove that production is its servant and not its master." To control the machine it has itself created is absolutely necessary if the country is to continue its orderly economic development.

Dealing more concretely with the homely problem of profits, trade abuses and unsound business practices, was the address of Edward J. Mehren, before the Department of Manufactures, which is published in part on page 290 of this issue. The two profit-destroying influences he attacks are the craze for volume at the expense of profit, and the profiteering of the buyer who plays one seller against another until he succeeds in breaking down the legitimate price structure.

The solutions for most if not all of these problems of business lie in the very practical sort of co-operation which the Chamber fostered with its program on "Teamwork for Prosperity." A teamwork among all branches of industry working through such organizations as the National Chamber will help to mold a united industrial opinion. Such opinion, in turn, will rid industry of the ruthless pirates and parasites, will put an end to trade abuses and unsound business practices and will direct industrial growth and development along the lines of economic benefit to the country as a whole.

Trade Groups Assume Larger National Significance

TRADE associations as members of the Chamber of Commerce of the United States are constantly becoming more influential and more helpful in that great federation of organized American business. These agencies are rapidly taking their deserved place and accepting their real responsibility in the National Chamber's affairs.

Many of the problems which confront organized business involve real or imaginary conflicts of interest between one region and another. It is well, therefore, that they should be judged on the larger basis of a national viewpoint. Such larger viewpoint is likely to be given to the Chamber outlook through representation of national trade and technical associations connected with single industries. They are of necessity free from any responsibility for the viewpoint of a single community or a single state, whereas the representative of a local or regional chamber of commerce or board of trade cannot by any means be so free. The best composite judgment will be developed by the blending that is now going on of the two points of view, that of distinctly geographic delegates and that of distinctly single-industry representatives.

Edgar Fahs Smith, 1856—1928

A MAN has passed. A chemist, a teacher, administrator, writer; Edgar Fahs Smith was all of these; but so are others. An authority in his field; recipient of the highest honors of his profession; such was the world's recognition, but even such distinctions are not unique. Scientist, scholar, sage; but primarily a human being, essentially a contributor to human welfare. His mind triumphed in the ultimate test of greatness, subservience to his kindly heart.

Fascinated in his later years by study of the history of chemistry, he wrote: "There is no grander field for research! A great satisfaction will come to those who undertake this work. It will bring them in contact, so to speak, with the men themselves." Now his own illustrious name heads the latest chapter of that history. The "field is grander" thereby; the promise of "satisfaction" is greater. May the heritage of his own insight enable future generations to see beyond his works, his writings, his achievements, and enjoy "contact, so to speak, with the man himself." Thus will the "human catalyst" continue to inspire an endless stream of students who will know, as do his contemporaries, that a *man* has passed.

Inter-Dependence and Food Processing

LAST January when *Chem. & Met.* initiated the current series of articles on inter-dependence of the chemical engineering industries, it was but natural that our plans should have called for a discussion of food processing. The immediate result was an interesting article by Dr. Seymour-Jones of the Borden Company which admirably met our specifications and exceeded them in pointing out an entirely new phase of our theme. The food industries are in themselves an inter-dependent group albeit this relationship is not always as evident as in the chemical engineering or process group.

A dependence upon science is not a recent discovery by the food industry. Scientific research has been actively prosecuted by nearly every major branch of the industry. We need only refer to the work of the National Canners' laboratories, the California Fruit Growers' Exchange, the American Baking Institute, and the several food-product fellowships at Mellon Institute, as a few of many well-known examples of organized research in this field. But while these various groups have independently carried forward their own single-industry programs there has not always been an appreciation of the many fundamentals that all of the food industries have in common. This community of interest is especially evident in the produc-

tion and processing operations. For example, the article in the present issue by Dr. C. Robert Moulton on "Chemical Engineering in the Meat Packing Industry" emphasizes as basically important such processes as sterilization and bactericidal control, curing and preserving, spray and drum drying, low-temperature vacuum evaporation and drying, temperature and humidity control, ventilation and air conditioning, refrigeration and even our old friends, corrosion and trade-waste disposal. Many of these are clearly in the field of chemical engineering; others are more nearly confined to the food industries. But the significant fact is that once the food industries appreciate the potentialities of this common interest in technology, the foundation is laid for a remarkable group development.

To foster such a development, *Chem. & Met.* gladly offers its columns as a clearing house for the exchange of technical ideas and for the building up of a fund of useful information. Technical men in the food industries are invited to discuss with us their common problems, particularly those dealing with manufacturing and processing.

Editorial Observations in Great Britain

Improvement Forecast By New British Budget

INTRODUCED in the House of Commons on April 24, the British financial budget held unusual interest for British industry. After its details were known there was general approval of its industrial features and it was hailed as a constructive measure. British taxation has been heavy ever since the war and industry has languished under the burden. Consequently there was a feeling of encouragement and relief when the plan of the present budget was announced. Speaking to the British Federation of Industries, Lord Gainford said that the budget constituted "the first recognition by a Chancellor of the Exchequer in his budget proposals of the fact that industry is the most important element in the country." Sir Alfred Mond also expressed the opinion that the new plans would do much for the revival and prosperity of industry, and characterized the budget as the most fruitful, far reaching and statesmanlike that had been introduced for many years.

One feature of the new budget is the distinction drawn between productive industries and the distributive trades, on the ground that the former are subject to world wide competition and cannot pass their burdens on to the ultimate consumer. British industry employs three-quarters of the wage earners of the country and accounts for nearly nine-tenths of the one million unemployed. The distributive trades, on the other hand, have prospered since the war. Hence relief will be afforded industrial producers in the hope of increasing production and employment. Benefits will also accrue to transportation, but these must be passed on to the productive industries. Agriculture is promised substantial relief.

One of the principal sources of new revenue is a tax of eight cents per gallon on gasoline, kerosene and light oils refined from imported petroleum. In addition to providing a large revenue, this tax is also expected to offer some encouragement to the Scottish shale oil industry (now quiescent) and to the production of benzol from coal. There will be no tax on these British-made products.

In addition to its taxation proposals the government has announced a policy of economy and reduction of expenditure. For example, the number of government employees, reduced by 7,000 in the last three years, will be still further reduced by 11,000 in the next five years. On the whole the new plans seem certain to give impetus to British prosperity, and the industrial outlook is distinctly favorable.

SIR ALFRED MOND'S ban on Russia is only one evidence of England's unwillingness to do business with the Soviet. Personal opinion is openly expressed here in London that England should have no business or political relations with a government that is notably lacking in business morality—having repudiated debts and seized property—but which is also secretly carrying on propaganda designed to undermine the political institutions of the country. Editorials in the daily press sound the same note of warning and call on Britain to cease buying Russian petroleum produced from seized British oilfields, and thus cut off a source of revenue now used to support Russian propaganda. In short, the undesirable influence of Bolshevism is more acutely sensed in England than in America and there is a demand that the country be rid of its representatives.

Ethyl Gasoline Under Investigation

DISCUSSION of the possibility of lead poisoning from the use of ethyl gasoline, now going on in England, is reminiscent of the controversy waged in America several years ago. The interest displayed here, however, seems mild in comparison to our own case. Daily articles in the press deal with various aspects of lead poisoning, most of them of a general character and seemingly not germane to the subject. For example, one deals with hazards to women and refers to possible poisoning from the use of ethyl gasoline in household cleaning—a remote possibility, it would seem, since the new motor fuel is intentionally colored a deep red. Another article deals with results of direct application of tetra-ethyl lead solution and ethyl gasoline to the skin of animals, American experiments being freely quoted.

For the most part the public discussions thus far appear to be of an academic character and not specially pertinent to lead poisoning from the use of ethyl gasoline as a motor fuel. The facts printed can be accepted as true, but the inferences implied and the deductions likely to be drawn by the uninformed do not follow logically. In fact, technical men have expressed opinion privately that the menace of lead poisoning from ethyl gasoline is not imminent and that much more is being made of the possibilities than the facts warrant. It seems likely, however, that the investigation will run its course as it did in America, and probably with similar results. On the other hand, England is much given to official regulation of industrial hazards, and restrictions on handling may be imposed here that were deemed unnecessary in America.

By H. C. Parmelee

IN MANY respects it would be difficult to contrive a more agreeable introduction to the chemical industries of England than a visit to Port Sunlight, home of Lever Brothers, Limited. Not only has soap manufacture here been brought to a high state of business organization and technical efficiency, but there has been developed simultaneously a beautiful village in a rural district where employees' living conditions are at their best. Located across the Mersey River from Liverpool, Port Sunlight comprises a self-contained industrial establishment and social community. The whole is a tribute to the genius of the late Viscount Leverhulme, founder of the company, whose deep interest in the human element in industry was evidently a dominant characteristic. The story of Port Sunlight, its conception and development, its work and its people, forms a great romance of industry.

The business organization, now world wide in its scope, represents a development from the original establishment in Warrington in 1886. There the works had an original capacity of 20 tons of soap per week, rising to 450 tons by successive enlargements before the limit of expansion was reached in 1888. At that time Port Sunlight was located on a marshy site that was gradually reclaimed and extended to provide facilities for the present impressive works. Mr. Lever's requirements for the new location were a "rural district where ample acreage could be secured adjacent to both rail and water transport, with reasonable facilities for obtaining the necessary supply of labor." It was also his expressed desire to build houses in which the work people would be able to live in pleasant homes provided with baths and gardens.

The first soapery at Port Sunlight had a capacity of 800 tons of soap per week, and the works were gradually enlarged to the present aggregate capacity of about 4,000 tons. The works area of nearly 300 acres contains soap and glycerine factories, oil and cake mills, alkali, printing and other works, offices and transportation facilities. In the village area of over 250 acres are more than 1,300 houses and cottages, recreation halls, athletic grounds, library, hospital, schools, church, the Lady Lever Art Gallery, a war memorial, parks and gardens. The houses are occupied only by employees of the company at rents just sufficient to cover upkeep and repair. The company's policy is not merely to improve working conditions in the factory, but also to create an environment which the families of the workers can share with them. There are no two blocks of houses alike; there are few rows and no tenements, and every house has its bath and garden.

UNDER the direction of a general service manager, industrial relations between employer and employed take on many varied aspects. Both parties contribute to joint funds for pensions and for health and unemployment insurance. Matters of domestic or personal concern are brought to the attention of the management through employees' advisory committees. Savings are encouraged by a guarantee on the part of the company to see that interest is returned at the rate of four per cent. Ideas and suggestions are invited and duly rewarded. Certain educational courses are provided for junior employees in a staff training college, classes being held on the company's time. A co-partnership trust in the company enables co-partners to share in the profits of the business. Social and village institutions exist in great variety, raising the standard of living above the average and making the community practically self sufficient in its social life.

Tangible results of the company's service policies are found in an almost negligible labor turnover and free-

dom from labor troubles. Employees and their families grow up in the service of the company, and consequently the general service manager has not found it necessary to take on an outside able-bodied man in five years. Nor is there difficulty with the unions. The union wage is the minimum paid, but substantially higher rates prevail based on unit costs of production in various departments. Piece work has been abandoned in favor of departmental team work.

Other aspects of the business are equally as impressive as the service department. Of science and technology there is a high appreciation. Laboratories were established at an early period in the company's history, and the present works has a large staff of chemists and technologists. A series of buildings are devoted to analytical, research and development work. All raw materials and finished products are closely controlled, and research is constantly under way for new products and improved processes. In the development department there is a complete small-scale soapmaking plant where the discoveries and investigations of the research laboratory can be tried out under semi-works conditions before being put into production.

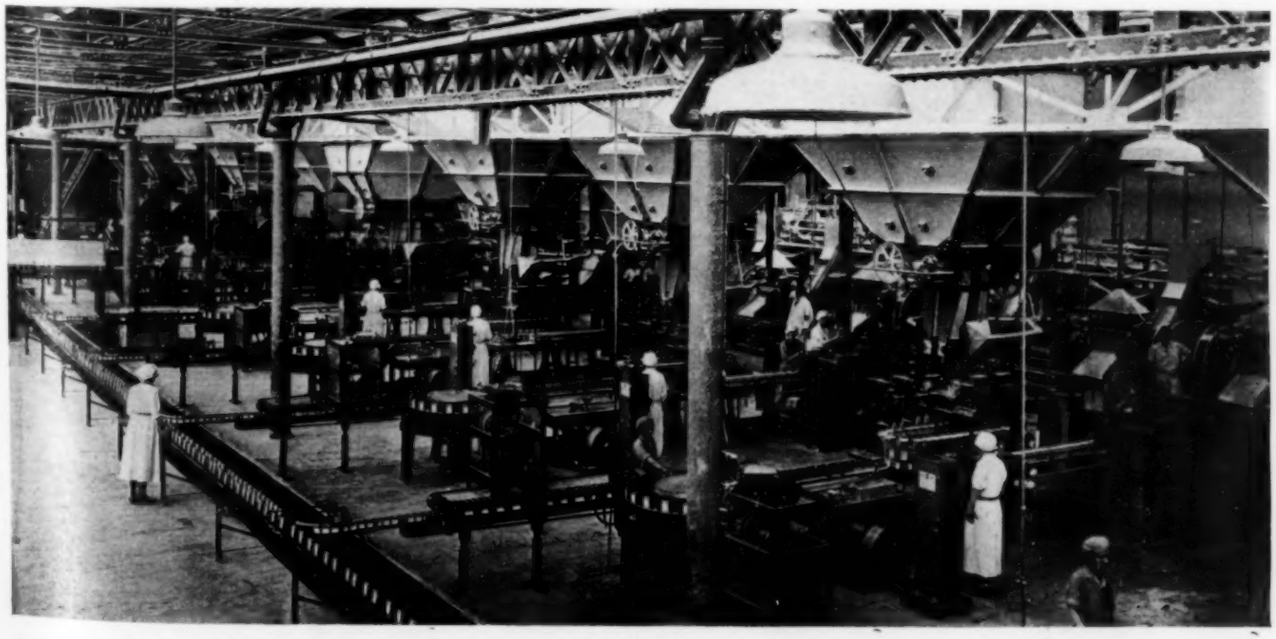
SAFETY in the works is highly organized under the direction of a special department. The efficiency attained by this movement is indicated by the fact that in 1927 only 13 accidents were recorded among nearly 9,000 employees. And of these it may be said that some were due to the folly and imprudence of the workers and not to a lack of reasonable provision against accident. Surgeries and rest rooms are established in the works in charge of trained nurses, and an ambulance brigade is organized for emergencies.

Production of soap is mechanized to a high degree. Material handling equipment and automatic appliances are used wherever practicable. Hand labor is reserved largely for those operations requiring human discrimination and selection beyond the ability of mere machines.

The world wide extent of Lever Brothers' operations is shown by their control of large plantations in Africa and the Pacific islands for the cultivation of coconuts, and in West Africa for the growth of palms. Whaling stations in South Georgia and oil refineries in Australia and elsewhere are included in their operations. Manufacture and distribution of their products are carried on in practically every country in the world. That an industry of such magnitude should have been built up within a period of 40 years is in itself a great achievement; but when the genius of its founder embraced not only business ability but appreciation of science and engineering and exceptional interest in the human element, the whole institution assumes a position unique among chemical industries.

Soap Boiling in One of the Kettle Rooms

Attention is directed to the construction of this building, or "soapery" as it is called by our British friends. There are five such soaperies at Port Sunlight.

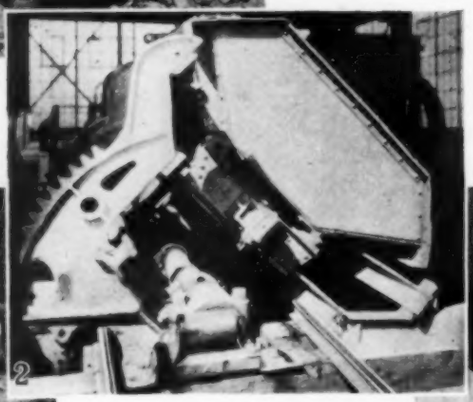


One of the Automatic Filling and Packing Plants in Which Lux is Prepared for the British Market

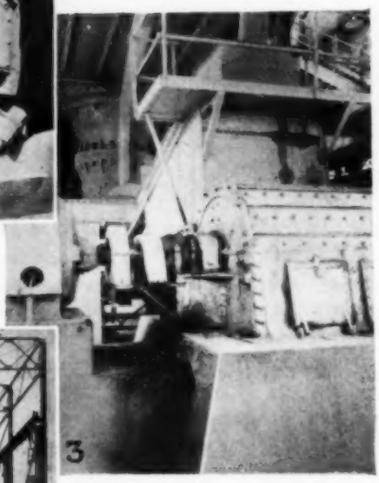
It is particularly interesting to note the extent to which these operations have been mechanized and the dependence upon automatic handling. Steel construction with adequate over-head lighting is another feature of this modern plant.

A Journey Through a New Portland Cement Mill

1.—The limestone quarry with the crusher building in the background

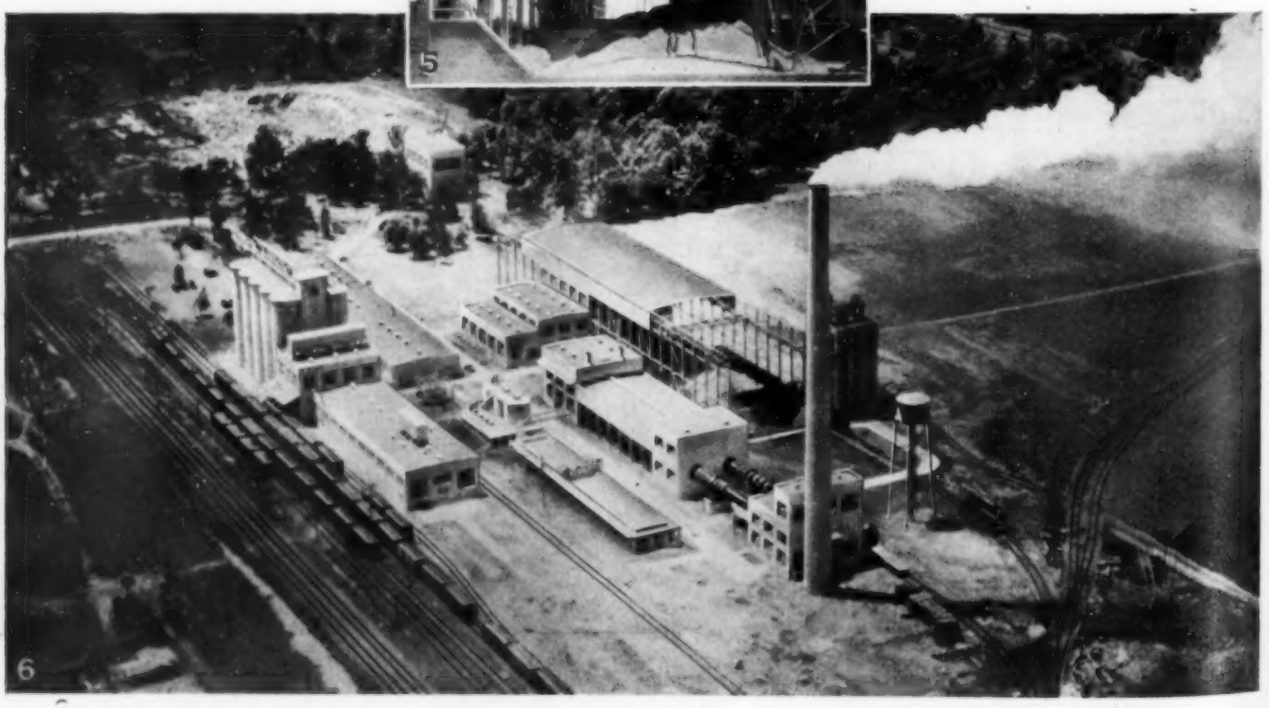


2.—The rotary car dump discharges limestone to the two crushers in (3)



4.—The belt conveys crushed limestone to the storage building in (5)

6.—The plant of the Phoenix Portland Cement Corporation from the air



Large Units Result in Notable Economies in Production

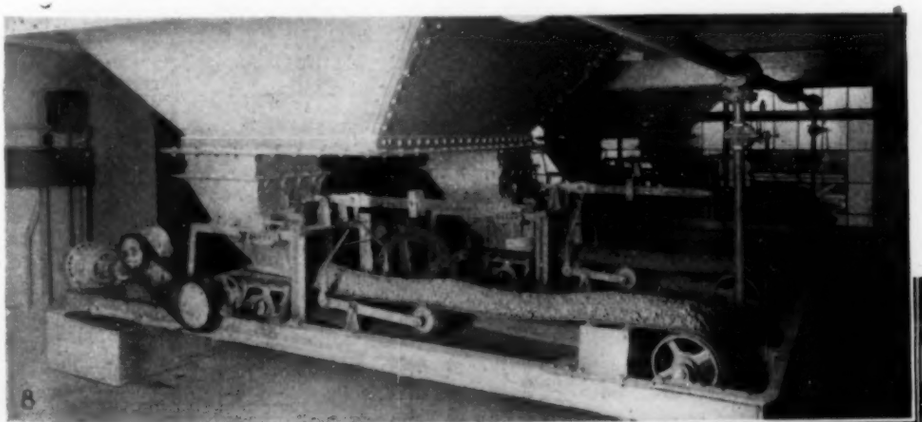
Staff Article

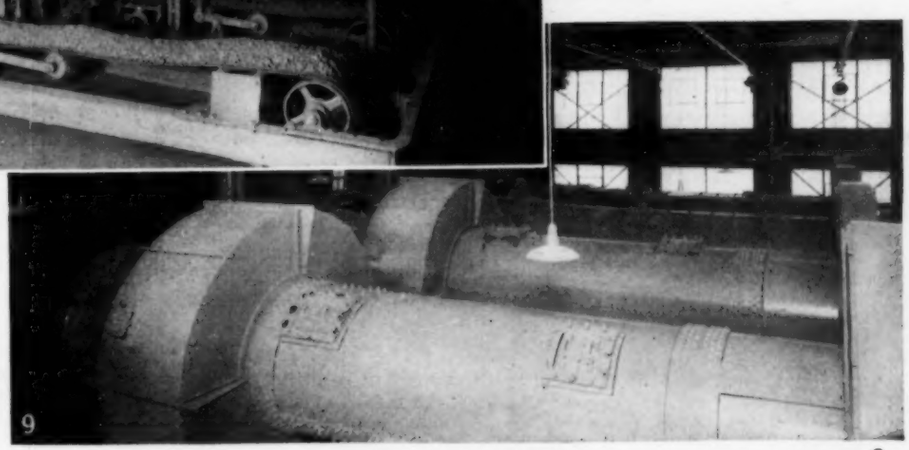
ALABAMA has long been known as a coal and iron producing state. That it is also developing as a chemical state becomes increasingly evident as its mineral and power resources are being thrown into the balance. Of its several important chemical industries, that of portland cement manufacture presents as well conceived a utilization of available raw materials as may be found in any section of the country. In the Birmingham district, close to extensive supplies of all the requisites there are now three portland cement plants, of which one, the new installation at Powderly, the Phoenix Portland Cement Corporation, may well lay claim to having the most modern set-up in the country. Whether this be strictly accurate or not, this company has an entirely valid claim to the two longest pieces of moving industrial machinery in the world, represented by two kilns each 343 ft. 9 in. long. The kilns give the plant a capacity of 4,400 to 4,500 bbl. per day, with a possible yearly output of close to 1,600,000 bbl., a figure not far below the entire state production in 1921.

The wet process forms the basis of the new installation. The plant was designed by engineers of the Phoenix Corporation, and was completed and placed in operation in January, 1927. A year of operation has fully justified the painstaking care with which the layout was planned in the direction of minimum handling, reduced maintenance and repairs, aesthetics, sanitary and comfortable working conditions and freedom from dust.

Limestone is quarried on the corporation's property at a point shown in the upper left of the general plant view on the opposite page. Shale and sandstone are brought in by rail from a quarry some fifteen miles distant on a switching rate. Gypsum and coal are likewise easily available by rail. Shipments of finished product are handled on two spurs of the main lines of the Southern R.R. and the Atlanta Birmingham & Coast R.R.

The plant is laid out on four parallel lines for minimum handling and direct flow of material. Reference to the ground plan on the following page will show that all raw materials with their receiving, handling and storage facilities form the first line. This includes the limestone quarry and crushers with conveying equipment for handling this material to storage. Coal, shale, gypsum and sandstone are received beside the storage bins and elevated from track hoppers by means of chain elevators which discharge to the respective storage spaces. Coal is elevated to the top of the coal mill by an automatic skip hoist from a track hopper. Here it passes by gravity through a crusher, thence through one of two air driers, and then one of two pulverizers of the rotating ball and race type, and is finally conveyed by screw pump in an aerated condition to the two storage hoppers in the kiln building. Clinker, direct from





7.—Upper right. "Main Street" of the Phoenix Corporation's plant

8.—Poidometers automatically proportion the raw mix as well as the gypsum and finished clinker

9.—The proportioned mixes are ground in these compartment mills. The two in the foreground are for raw grinding while the remaining two grind the finished product

the kilns is delivered to another portion of the general storage area.

The second equipment line includes the raw and finish grinding mills, the kiln house and the stack. This is properly grouped with the third line which contains not only the administration, stores, shop and laboratory building, but also the remainder of the equipment for the intermediate processing stages. This consists of the mixing, correcting and slurry storage tanks. The fourth line comprises storage silos for finished cement and departments for bagging and shipping and preparation of the bags. These departments include the pack house with its four automatic baggers and bag tiers and the bag

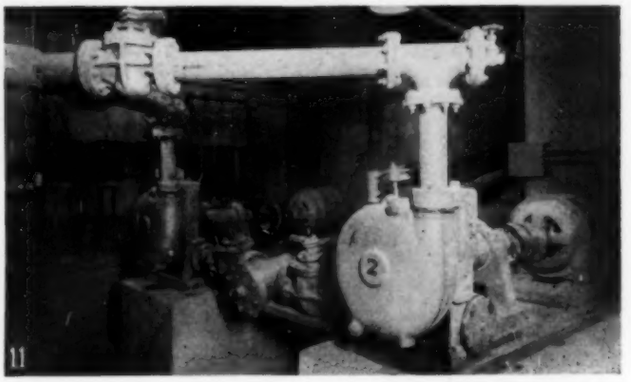
In Fig. 10 above is the 200x25x21-ft. Slurry Storage Basin Where is Stored Three to Four Days' Milling

house where returned bags are dusted and cleaned, repaired and stored preparatory to refilling. This line also includes the two loading tracks, one on either side of the pack house from which the shipments are loaded into the freight cars.

Limestone, as quarried, is loaded by electric shovel into 10-ton steel cars drawn by an electric storage battery locomotive. The cars are delivered to the foot of the incline where an electric hoist hauls them to the top of the crusher house. Here a rotary dump discharges the stone to a 42-in. gyratory crusher, reducing the material to 6-in. size. The lumps are further reduced to ½-in. in a hammer mill and thence delivered to a 30-in. conveyor, 350 ft. long, and discharged to the general storage building, adjacent to the bins for the other raw materials. Two 10-ton overhead electric cranes handle all material in this area. One is provided for limestone, shale, sandstone and gypsum, while the other handles coal and clinker. Materials in approximate proportions are elevated and dumped into hoppers at the side of the building. The hoppers feed poidometers which automatically proportion the mix for the raw grinding mills forming the next process stage. This feature is in a measure responsible for the accurate control which is a feature of this plant.

The mill building, abutting the storage space on the south, contains in addition to two mills each for raw materials and finished product, the air compressors and a pair of motor generators which supply direct current for all variable speed auxiliaries throughout the plant. Two 8x7x40-ft., three compartment pebble mills driven at 25 r.p.m. by 800 hp. synchronous motors and working in parallel, grind together limestone and shale, with what sandstone may be required, forming a wet slurry with 90 per cent through 200 mesh. Creek water is supplied to the mills with the proportioned materials at

Below in Fig. 11 are the Slurry Pumps. They Transfer Slurry from Storage to the Kiln Feed



the entering end. The resulting slurry, agitated by air, flows to one of two 4-in. centrifugal sand pumps and is pumped to one of a group of three correcting tanks where the mix is agitated continuously. Here it is analyzed and brought up to standard composition. It is then dropped by gravity to an agitated mixing basin in which batches from the three correcting tanks are combined to insure uniformity. An air-lift pump carries the slurry from the mixing basin to a rectangular slurry

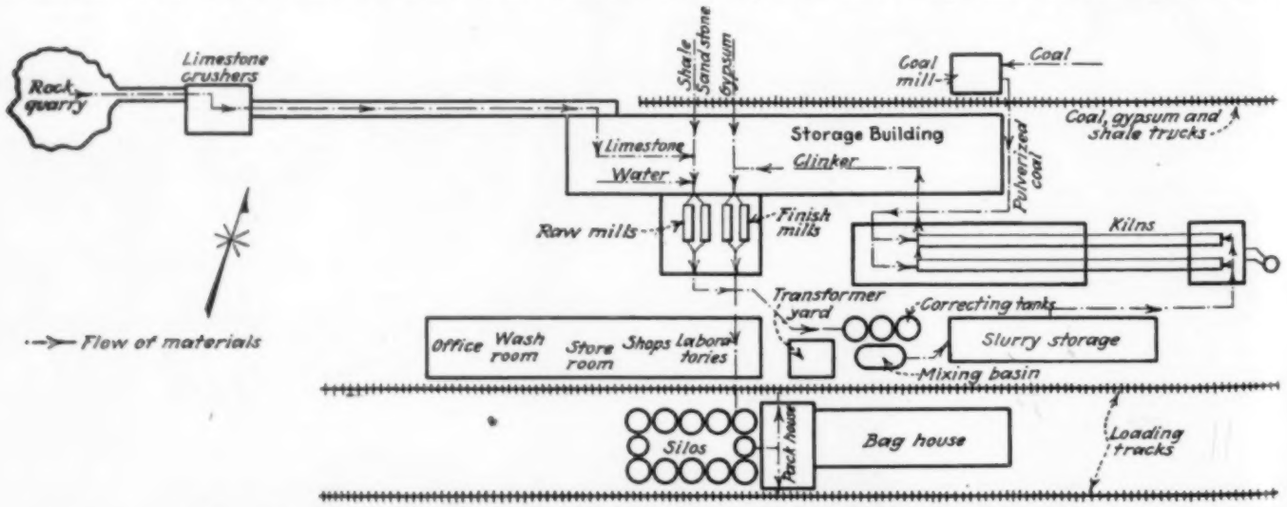


Fig. 12—General Layout of the Plant and Property of the Phoenix Portland Cement Corporation

Raw material producing, receiving, handling and storage equipment form the first line at the north. Next, there are the grinding mills, kiln house and stack. Below are the offices, stores and laboratories and the slurry handling equipment. Finally, facilities for storage and shipment of the finished cement complete the plant

storage tank 25 ft.x200 ft.x21 ft. deep. Here a traveling agitator equipped with three paddles ensures continuous suspension of the slurry. The capacity of this tank of three to four days milling further provides for the uniformity of the slurry composition so important in a high early strength cement.

From a sump below the storage basin, the slurry is pumped to feed tanks in the kiln feed house whence it is delivered continuously to the kilns by means of ferris-wheel type kiln feeders. The kilns, as has been pointed out, are the largest in the world. They are each 343 ft. 9 in. long by 11 ft. 3 in. in diameter for the first 120 ft. at the discharge end and 10 ft. in diameter for the remainder. Five ring and roller bearings, each with three sq.ft. bearing surface support the kilns. One thrust bearing is also provided. In the first 112 ft. of the cool end of each there is looped 4,000 ft. of $\frac{7}{8}$-in. chain which not only serves to agitate the slurry and break up rings of material, but so effectively acts as a medium of heat transfer that the flue gas exit temperature is reduced to between 600 and 700 deg. F. In addition, the chains act as dust arresters. It is significant that this is one of the most dustless plants in the country.

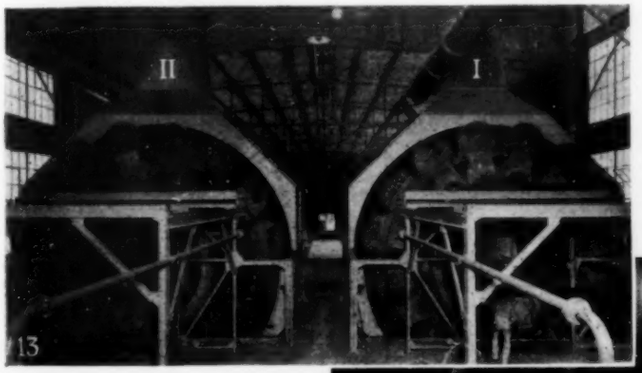


Fig. 13 Shows the Clinker Discharge End of the Two 344-ft. Kilns. Fig. 14 at the Right Shows the Conveying Equipment and the Cleaning Equipment for Returned Bags. In Fig. 15 are the Automatic Baggers

Kiln lining consists of 9-in. fire brick in the hot end, and 6-in. brick in the cool. The drives consist of 100 hp. adjustable-speed d.c. motors operated from a master control board at the kiln discharge end of the building. It is interesting to note that despite their enormous size, the kilns have been found to require actually only 60 hp. Clinker is discharged from the kilns through Unax cement coolers direct to a shaker conveyor and thence to storage. Three screw conveyors collect dust from the kilns and transport it to an elevator for hoisting the dust to the slurry feed.

Induced draft for the kilns is provided by four adjustable speed fans usable to temperatures of 700 deg. F. Through an automatic control, cold air is admitted to the smoke chamber to cool the flue gases in the event that their temperature should go above this amount. The previously pulverized coal from the coal hoppers above the burner's platform is blown into the kilns by air from adjustable-speed blowers and fed by controllable screw conveyors. Motors for the kilns, blowers and screws are controlled and kiln speed, draft and slurry feed rate are indicated at the master control board. Labor requirements are kept at a minimum.

Clinker and gypsum from their respective storage spaces are picked up by the storage building crane and charged into hoppers beside those for the raw materials. Poidometers again proportion these materials and feed through screw conveyors to one of two 8x7x40-ft. ball mills revolving at 19.9 r.p.m. where the product is finish-ground dry to 88 per cent through 200 mesh. This is some ten points finer than standard specifications, resulting in a very high early strength which comes, not from any difference in composition of this cement from the average but rather from its unusually fine texture and uniformity.

The ground cement discharges from the mills to two cement pumps which transport it to the storage silos. The capacity of the latter is 150,000 bbl., divided between twelve silos and the rectangular storage space bounded by the silos. Ten silos 25 ft. inside diameter and 80 ft. high are arranged in two parallel lines. The end space is closed by two silos 16 ft. inside. The enclosed space provides one large bin about 90 ft. long by 20 ft. wide. Cement is removed from the silos by three parallel underground screw conveyor lines discharging to two shorter conveyors at right angles to the first. The latter feed two enclosed chain elevators which elevate the cement to the bins of four bag packers in the pack house. Again automatic machinery assists in keeping the labor requirement at the absolute minimum.

Adjoining the pack house is a building devoted to storage, cleaning and repairs of returned bags. An elevator lifts the bags to a bag cleaner where they are shaken to remove the clinging cement. Dust which is recovered from the cleaner is taken by a dust screw running the length of the bag house to the cement elevator feeding the packers. A dust collector placed on the roof of the bag house ensures a dust-free atmosphere in this building. Another collector on the roof of the pack house handles dust from the packing machinery. The latter are capable of filling three bags per machine simultaneously. Bags are tied automatically and delivered by conveyors to one of two shipping platforms where the finished product is loaded into freight cars for removal from the plant.

For the privilege of conducting its readers through one of the most interesting and instructive of the country's portland cement plants, *Chem. & Met.* is very grateful to the officials of the Phoenix Portland Cement Corporation. Acknowledgment is made especially to Mr. Lindley C. Morton, president of the company, for his hearty co-operation and freely given assistance in the preparation of the manuscript.

Chemical Engineering Progress in Varied Industrial Fields

Editorial Staff Report

EDITOR'S NOTE. *Industrial interest in the Spring meeting of the American Chemical Society held in St. Louis during the week of April 16 centered largely in a series of round table discussions before the industrial and petroleum divisions, and at the sessions devoted to papers on gas and fuel, water and paint and varnish. Brief reports of papers and discussions of chemical engineering interest follow.*

Filtration and Equipment Round-Tables

Industrial division of A.C.S. discusses trends in process development and chemical engineering equipment construction

DAVID R. SPERRY, filter manufacturer of Batavia, Ill., opened the round-table discussion of filtration by presenting a paper entitled "The Effect of Pressure on the Fundamental Filtration Equation when the Solids are Non-Rigid or Deformable." This was largely a detailed description of test apparatus for graphically recording the volume of filtrate and the time intervals during the test. A large number of results on suspensions of starch, kieselguhr, a red color, mason's lime and fullers earth were presented. These results were interpreted with the aid of an empirical equation and coefficients of compressibility obtained. Among the conclusions was the surprising result that the coefficient for kieselguhr was greater than that for starch.

Discussion centered largely around the paper of Sperry. Professor Mann of Minnesota referred to the anomalous behavior of starch and kieselguhr, and asked for explanation. This resulted in an analysis of the meaning of "compressibility," and it was suggested that this is not entirely a property of the solid material itself but of the agglomerate of solid and absorbed solution. Dr. W. G. Whitman of the Standard Oil Company of Indiana referred to the possibility of settling or decantation occurring between the filter plates during an experiment, and pointed out that this is an extremely difficult thing to prevent and might cause significant variations in results. Doctor Krase of the University of Illinois inquired relative to the possibility of predicting the compressibility of a mixture from the compressibility of the separate substances. No data were available.

Several other speakers suggested the desirability of extending filtration data to higher pressures, at least to that range used in many industrial operations. In this way the uncertain data pertaining to the initial stages of filtration become of less importance, and the results are therefore more reliable.

Prof. W. T. Read of Texas Technological College had prepared a comprehensive paper on the general trends in the construction of chemical engineering equipment but due to an unfortunate illness he was forced to return to his home. In his absence the paper was read by H. E. Howe, and the discussion that followed was led by Robert J. McKay of the International Nickel Company, chairman of the industrial division. The general trends indicated by Professor Read and some of the examples he cited follow:

1. Adaptation of well-known and thoroughly standardized equipment to new uses. This penetration of chemical engineering equipment into new fields is exemplified by the introduction of rod mills in the pulp and paper industry, by the application of the Dorr thickener in cement, ceramic, water and sewage work, or by the application of the Cottrell precipitator in removing tar from gas.

2. Combination of unit operations to avoid excessive handling of materials and to obtain advantages not hitherto possible. This, in a sense, represents the trend from batch to continuous operation. Many interesting combinations were cited—among them, that of filtration and drying of lithopone as shown by Filtration Engineers, Inc., at recent chemical expositions. Another is the combination of dry grinding with air circulation and classification.

3. Development of better and more efficient methods of measuring, regulating and controlling operations as shown by the tendency toward automatic and distant control. Instrumentation has been developed to a remarkable degree in the gas and petroleum refining industries through automatic control of temperatures and pressures, continuous calorimetric and gas analysis instruments. An automatic specific gravity control instrument on an evaporator to take the place of hand operation is an interesting example. In one case the record shows 1,600 manual adjustments of a single valve in a day.

4. Extension of working pressures both in the direction of very high pressure and very low pressure. For example, in petroleum refining the cracking operations are being carried out at pressures in excess of 1,200 lb. per sq.in., while lubricating oils are made in vacuum stills operating continuously at extremely low pressures. The high pressure era ushered in by nitrogen fixation and the methanol synthesis has been possible only through the development of satisfactory materials of construction and the design of efficient joints, valves and similar accessories.

5. New materials of construction definitely adapted to special uses making possible more favorable conditions of operation. These include alloys, plastics, refractories, glass and ceramic materials. Among the metal applications Professor Read cited, the increased use of aluminum in pure form and as alloys, and the successful use of pure nickel in fabricating alkali evaporators. Chromium, through its various alloys and in plating, came in for much discussion. An interesting example was the use of a nickel-chromium alloy retort in a particularly severe service in which it withstood a temperature of 1,100 deg. F., for 30,000 hours. Chromium plating and the process known as Stelliting have added greatly to the life of equipment. Silicon-iron alloys have been so improved in physical properties that they are being used in increasingly large applications. The development of a new nitrocellulose filter fabric was cited as a trend toward synthetic materials. Radiant heat, it was reported, has been made possible as an industrial agency

largely by the development of better refractories, particularly silicon carbide.

6. Increasing readiness of manufacturers of equipment to apply scientific, engineering and mathematical principles to the design of equipment and to do extensive and thorough physical and chemical research. This trend has helped to eliminate much of the war-time methods of cut-and-try that resulted in unsatisfactory and poorly designed installations. Service departments that function on an engineering basis entirely apart from the sales organization have helped in this direction. Perhaps the greatest contribution has been that of the colleges in the development of personnel trained in chemical engineering principles and application.

7. Growing desire for standardization of equipment rather than special designs for each industry and each manufacturer of chemical products. Greater progress in this direction would enable equipment manufacturers to take advantage of mass production and reduce costs. Unfortunately the attitude of secrecy is still maintained in some chemical industries and has greatly retarded such progress. The growing tendency of engineering firms to build and operate complete plants helps to foster the standardization movement.

Discussion following the reading of Professor Read's paper was confined largely to the relations between the producer and user of the equipment. An instance was cited in which acetic acid had to be handled under unusual conditions of temperature and pressure. It was said that sweeping sales statements were made by the alloy manufacturer, presumably on the results of laboratory tests, but all of the alloys failed in actual service. Robert J. McKay emphasized the importance, if not the absolute necessity, for studying the specific application in the plant under working conditions. He cited the fallacy of relying solely on laboratory results.

The question of the extent to which the equipment manufacturer should share in the results of development work carried on within the user's plant brought forth a sharp division of opinion. Dr. W. G. Whitman of the Standard Oil Company of Indiana held the view that most chemical engineering developments must be carried on independently of the manufacturer. Otherwise a competitor who buys the equipment will have an unfair advantage. M. A. Williamson of *Chem. & Met.* urged the importance of developing a professional relationship comparable to that of a lawyer and his client. Unless the equipment user has confidence in the equipment manufacturer and is willing to work with him on such a basis, both are handicapped. Confidential detailed information may often be required by the manufacturer, in order to serve intelligently the needs of the user. No reputable manufacturer, however, would reveal such confidential information to a competitor of his client. He would be justified in using only the general principles and experience gained as a result of his contact.

Lubrication Problems at Low Temperatures

Petroleum and industrial divisions hold joint session on recent developments of interest to maker and user

THAT lubrication problems continue to hold the interest of both producer and consumer of lubricants was evidenced by the round-table discussion in which the petroleum and industrial divisions jointly participated. The meeting was, in a sense, a continuation of the Tulsa symposium of 1926 (see *Chem. & Met.*, Vol. 33, No. 4, p. 211) although much of the discussion was confined to the problems of lubrication at comparatively low temperatures.

In the absence of R. E. Wilson, D. P. Barnard acted as temporary chairman and opened the discussion with a description of some recent work done by the Standard Oil Company of Indiana (*J. Soc. Auto Engrs.*, Vol. 22, p. 213. 1928). This investigation was carried out for the purpose of determining the effects of viscosity and pour test upon the performance characteristics of automotive engine oils particularly under the conditions involved in starting engines in very cold weather.

The first stage of this work consisted in determining, by means of a modified Saybolt viscosimeter, the viscosities of a number of oils at temperatures as low as —10 deg. F. The results obtained were most interesting. The conclusions resulting from this work were as follows:

1. At very low temperatures all of the oils exhibited plastic properties. These were most marked in the paraffin base oils and least in those of asphaltic origin.

2. Under fairly high shearing stresses the observed viscosity values agreed well with those predicted by extrapolation of normal temperature data. (Lubrication, pub. by The Texas Co. June, 1921; also *Oil & Gas Jour.* Dec. 2, 1926, p. 146.)

3. Tests on four different engines indicated that, over the temperature range +180 deg. F. to —20 deg. F. resistance to cranking was determined entirely by oil viscosity at the cranking temperature as determined by extrapolation of normal temperature data.

4. The A.S.T.M. pour point had no noticeable effect on cranking effort. Tests with an engine having a rather fine screen, however, indicated that, when flow through the screen depended on gravity, circulation could be effected only at temperatures above the pour point.

The results of a similar investigation carried out by the Atlantic Refining Company were reported by J. C. Geniesse. In addition to confirming the conclusions of the previous discussion this work presented some much more extended data on circulating systems. Tests with screens of several sizes and with pumps in some cases immersed in the oil and in others raised as much as 10 inches above the oil level showed that, while flow could be obtained only at temperatures above the pour point of the oil used, the amount circulated by a pump placed above the oil level and drawing oil through a suction pipe depended entirely upon the oil viscosity as determined by extrapolation from normal temperature inspection data. In every observation of cranking effort and oil circulation the effect of viscosity was the same, no difference being noted between a light oil and one of the same viscosity made by diluting a heavier oil with a non-viscous diluent.

Results of research along a different line were described by C. E. Gilson of the General Electric Company, who told of some work with lightly loaded bearings operating at very high speeds. In accordance with general understanding the conditions were such that lubrication should have been of the fluid film type and therefore unaffected by any specific surface action. Nevertheless, although the parts were reproduced as accurately as possible by the best of workmanship, different friction effects were noted when bearing composition was changed by using first a bronze, then a brass, a high tin babbitt and a high lead babbitt. Furthermore, substituting a nickel steel journal for the usual carbon steel resulted in reversing the order of variation in friction previously noted.

The possibility of improving locomotive journal lubrication was discussed by F. L. Koethen of the Acheson Graphite Company, particular emphasis being placed on the necessity for insuring a steady supply of lubricant. In answer to several questions G. L. Baxter, of the Southern Pacific Railway Company, described some developments along the line of oil lubrication of locomotive journals and stated that one experimental system was about ready for trial on his road. It was very evident that an urgent need exists for better lubricating systems than the antiquated grease cellar now in general use.

Chemical Studies in Field of Coal Processing

Gas and fuel division discusses gas enrichment, coal-tar extraction, and methanol synthesis

RECENT work done by the U. S. Bureau of Mines on the flammability of carbon monoxide and methane air-mixtures, reported by G. W. Jones and G. St. J. Perrott of the Pittsburgh station, shows that the limits of flammability of automobile exhaust gases depend largely upon the air-fuel ratio of the fuel mixture. It was found that automobile exhaust gas is only flammable when the carburetors are rather richly adjusted—that is below an air-fuel ratio of about 11.75. The exhaust gas liberated by the average carburetor adjustment (12.5 lb. of air to one of gas) is non-flammable when mixed with air at ordinary temperatures. The feasibility of eliminating carbon monoxide in exhaust gases by burning it with admixed air was discussed.

Permissible variation in the heating value, composition, and specific gravity of city-gas supply has been investigated by R. B. Harper who reports upon the first series of tests which he has made with mixtures of coke oven gas with water gas and mixtures of carburetted water gas with natural gas. The first series of tests show the typical household and industrial gas-burning appliances will function satisfactorily when the specific gravity of the mixed gas varies not more than 20 per cent above or not more than 10 per cent below the gravity for which the appliance is ideally adjusted. This conclusion assumes, however, that pressure is kept within limits of 50 per cent above or below the pressure for which the appliance is adjusted. These results are in general in conformity with earlier reports by other investigators who have been studying this subject for the American Gas Association. A second series of tests which has been carried out only in a preliminary way indicates a tentative conclusion as to the permissible change in heating value with constant specific gravity. The results seem to show that a drop of 12 or 13 per cent in heating value from normal can be tolerated but that a drop of 18 or 20 per cent produces unsatisfactory functioning of appliances. A second tentative conclusion indicates that it is not possible with our present information to compensate for change in specific gravity of gas by changing the supply pressure.

Six competitive methods for enrichment of blue gas were compared by R. V. Kleinschmidt, including carburetting with gas oil, cold carburetting with propane, enrichment with cracking-still gases, admixture of natural gas, mixing with coal gas from either ovens or low-temperature retorts, and use of methane made by synthetic processes from the blue gas. The most profitable method for use in any plant depends upon the particular conditions prevailing locally. The most radical proposal made by the author was that gas companies should go into the business of gasoline manufacture in order to have the cracking-still gases available. It was pointed out that in general enrichers are valuable in proportion to their heat content; but in certain cases the enricher which furnishes the highest heating value per cubic foot in its own vapor is worth slightly more per 100,000 B.t.u. than those of lower heat content. This is true because when high-concentration enricher is used to make a given quality of mixed gas a larger percentage of the total mixture will be the cheaper blue gas. The over-all cost is, under these circumstances, the lowest.

Published values of the equilibrium between methanol and carbon monoxide and hydrogen have been obtained from low temperature specific heats and from rough measurements of the equilibria in two decomposition reactions involving methyl formate in addition to methanol, hydrogen and carbon monoxide. The first method gives $K = CH_3OH/(H_2)^2CO = 10.6$ at 200 deg. C. The second method gives $K = 0.055$ at this temperature. In view of the importance of the methanol-water gas reaction, this large discrepancy led D. F. Smith and B. F. Branting to develop a direct method, in which equilibrium was approached from both directions. Their research has established the equilibrium point at 250 and 300 deg. C. with an accuracy far surpassing that of any previous determination. It is shown that the measurements of Christiansen are far closer to the true value than are the values by the first method mentioned. The maximum possible yield of methanol from water gas is thus somewhat lower and the catalysts used are more efficient than was previously supposed.

S. Caplan and P. W. Dilthey presented a paper on the extraction of tar acids with alkali from primary tar distillates. Contrary to the published results of previous workers they found that there is no optimum concentration of caustic soda solution for the complete extraction of the tar acids from low-temperature tar oils. The effect of concentration of alkali on the degree of extraction as well as on the purity of the extracted phenols was investigated and the use of successive washes with aliquot portions of dilute solutions of NaOH was studied. An attempt was made to explain previous results on the basis of oxidation of the high boiling tar acids in alkaline solution but this was found to have no effect.

In the discussion of this paper Doctor Layng brought out the fact that repeated washings with water extracted a relatively large amount of material from tars, the extracted material being insoluble in sodium hydroxide.

A series of physical tests of coke have been made by A. R. Powell and D. W. Gould in a coke tumbler following a design suggested by Mr. W. A. Haven, and recently suggested for adoption by the American Society for Testing Materials. Duplicate tests in the coke tumbler give results which are concordant within 1.4 per cent for the stability factor (total percentage on 1 inch), and within 0.8 per cent for the hardness factor (total percentage on ¼ inch), the agreement being closer than duplicate tests with the standard shatter test.

Comparative results were given for 26 different cokes as to shatter test, tumbler test, and how these compare with actual plant yields of coke over 1 inch and coke over ½ inch. In general, the tumbler test gives results more comparable to actual plant yields.

Industrial Water Treatment Prevents Corrosion

Chemical engineering interest in new developments in methods and materials

TREATMENT of water for use in locomotive boilers was the subject of several papers and came in for considerable discussion before the division of water, sewage and sanitation. The annual bill for corrosion in locomotive boilers alone is estimated at from 12 to 15 million dollars.

L. O. Gunderson presented the view that differences in electric potential due to thermoelectric currents had a great deal to do with corrosion. Insulated rods set up in locomotive boilers showed appreciable electric current and the potential difference between hot boiler tubes and the comparatively cold surface of certain portions of the boiler should be measurably greater. He also brought out the polarizing effect of such elements as arsenic.

The use of artificial zeolite softeners as used by the Southern Pacific and of lime-soda treatment of Missouri River water for locomotive use were well set forth in papers by George L. Baxter and H. H. Richardson. S. C. Johnson showed that savings could be made by treatment of boiler feed waters of low incrustant content such as are found in New England and the Atlantic States.

Clarification and treatment of domestic water supplies also received attention. Ripple, Turre, and Christman presented the advantages of sodium aluminate in their paper, "The use of liquid sodium aluminate in the clarification of the Denver water supply." John R. Baylis' paper on "Hydrogen-Ion Control in Water Softening," was read only in abstract, due to the absence of the author, but it and the paper by Buswell and Shoebotham on "The chemistry of sodium aluminate," created the most interesting discussion and comment of the session. An important trend is evident here.

Aug. V. Graf gave a description of water softening at St. Louis, A. H. Kneen presented the advantages of zeolite water softening at Bellevue, Pa., while Hoover, Hansley, and Sheely advocated the use of zeolite after lime treatment and carbonization as practiced at Columbus.

In general the advocates of zeolite softening agents as against lime-soda treatment were about evenly divided. The most enlightening fact to both the layman who know little about water treatment and the expert who has gone through the major water softening processes and come out on the other side, is that industries, and especially railroads are convinced that water softening pays and pays well. The extensive research and experimentation now going on on all sides should bring out many new developments in the near future.

Lacquer Progress Reflected in Varnish Research

Paint and varnish division considers properties and manufacture of synthetic resins, accelerated tests, and pigment settling

ACCELERATED tests of protective coatings, the adhesion of films, and pigment settling, were among the questions of interest to the members of the Paint and Varnish Division of the A.C.S. The discussion was well started by the paper of Walker and Hickson, "Accelerated Tests of Organic Protective Coatings." In their paper they explained the development and use of apparatus for comparative tests of organic coatings subjected to light, moisture, heat and cold, similar to that of weathering, whereby effects comparable to from one to two years of natural weathering could be obtained in a period of from one to three weeks.

A well prepared paper by Hofmann and Reid on the formulation of nitrocellulose lacquers showed by charts and diagrams the range in which good lacquers can be formulated from the two general groups of materials—the non-volatile, consisting of nitrocellulose, resin, and plasticizer—and the volatile group, consisting of nitrocellulose solvent, an alcohol, and a hydrocarbon. The experimental data included comparisons of such lacquer properties as gloss, adhesion, flexibility, hardness, blushing, lifting and brushing properties, and the charts presented showed graphically the range in which the desired lacquers might be varied to suit various commercial purposes.

The use of synthetic resins in varnish making was exemplified in a paper by Stauderman and Beakes of the making of a synthetic resin varnish, the outstanding feature being a varnish that will dry in from three to four hours. This and the paper, "Acetone Condensation Resins," by Gardner and Knauss, point, emphatically, to the trend of varnish research in attempting to capitalize on the sudden popularity of the nitrocellulose lacquers.

"The Displacement of Mutually Miscible Liquids from Solid Surfaces," by Osterhof and Bartell, has its commercial application in the fact that a thinner although miscible in the oil may so displace it on the surface of the pigment by preferential wetting that the pigment may settle and leave the oil completely.

White paint after weathering may show better heat reflecting ability than weathered aluminum paint on metal storage tanks due to the fact that the white paint chalks more or less and still presents a white surface while the aluminum paint darkens, as was brought out by the paper of Nelson and Jamieson.

Bonnie and Henlein in their paper, "Chemical and Physical Characteristics of Red Lake Pigments," disclosed interesting facts about the manufacture and the characteristics of lake pigments. How black is black can easily be measured by the comparometer discussed by C. R. Johnson. The instrument cannot as yet be applied to colors.

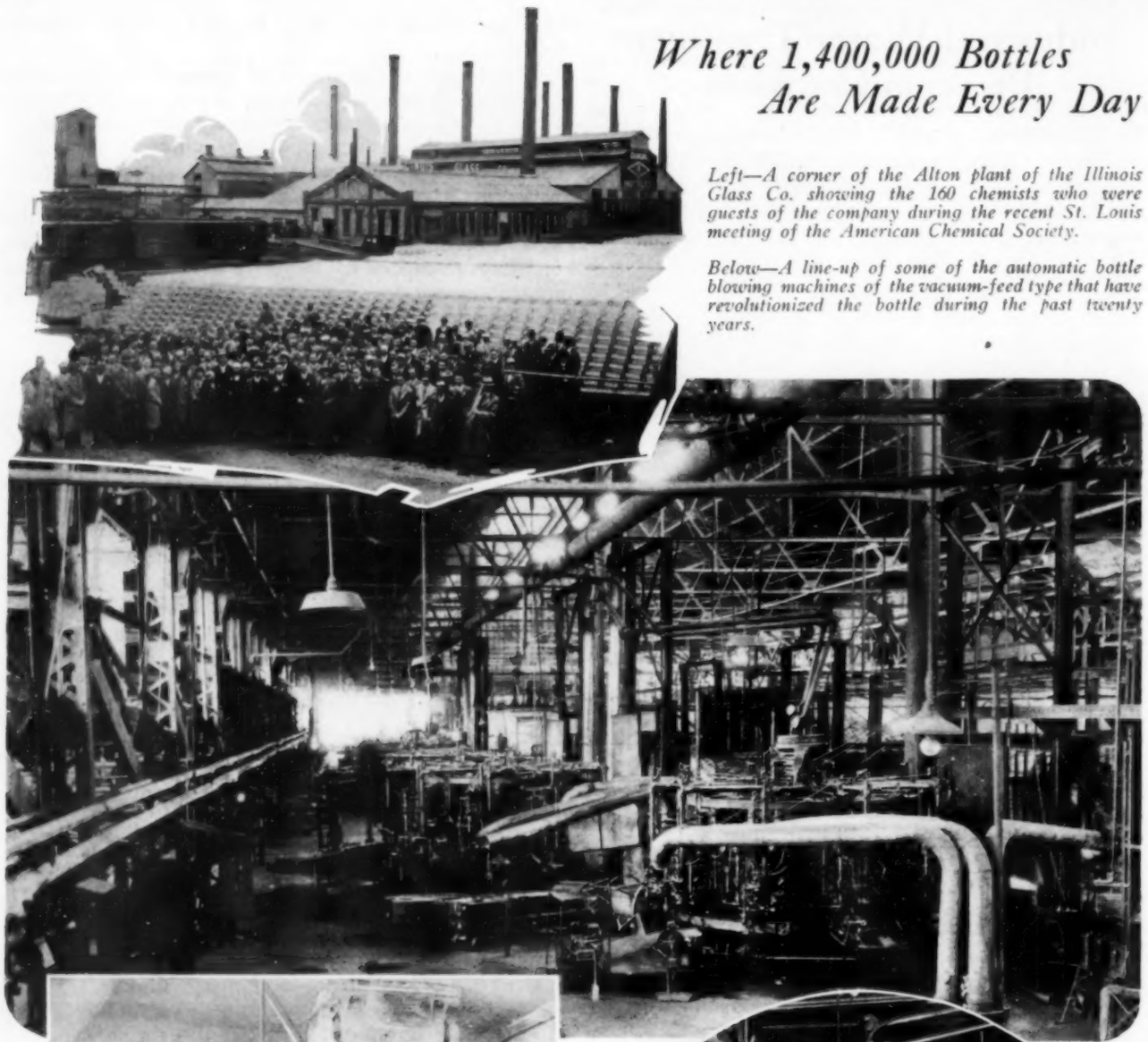
Other papers included two by J. S. Long and associates describing work on drying oils, specifically the action of cold blowing on linseed oil, and the adsorption of liquids by oil gels. A paper by F. W. Hopkins described rapid drying finishes for wood surfaces.

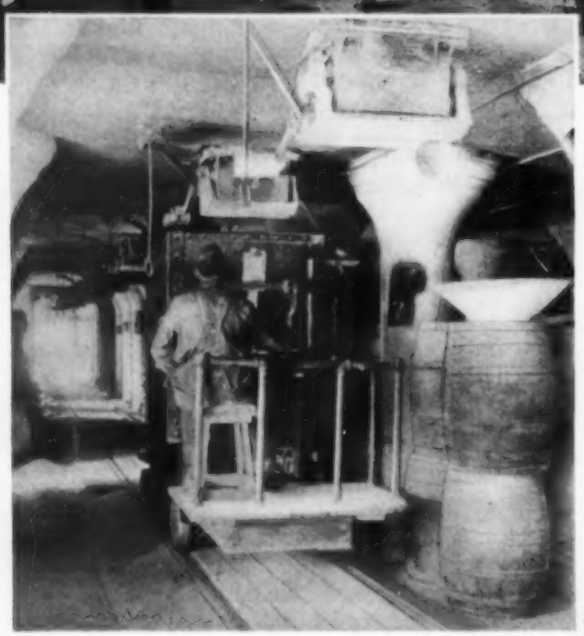
The concluding session was devoted to a symposium on pigment settling which developed both theoretical and technical discussion. In general the meeting was marked by live interest in the papers presented and is notable for the fact that so many industrial laboratories presented papers through their representatives.

Where 1,400,000 Bottles Are Made Every Day

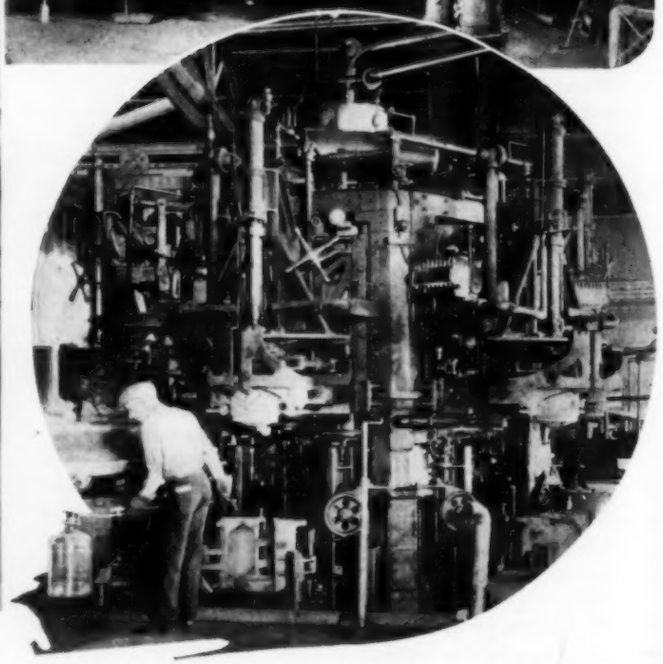
Left—A corner of the Alton plant of the Illinois Glass Co. showing the 160 chemists who were guests of the company during the recent St. Louis meeting of the American Chemical Society.

Below—A line-up of some of the automatic bottle blowing machines of the vacuum-feed type that have revolutionized the bottle during the past twenty years.





Electric weighing truck that collects and measures the sand, lime, soda ash and other ingredients that go to make up the glass batch. After the proper quantity of each ingredient is weighed into the truck, its contents are dumped into the batch mixer, from which the mixed raw materials are fed to the furnaces.



This automatic machine makes 7,500 to 8,000 big 5-gal. bottles every 24-hours. It is the "Big Bertha" of the bottle world as it is 32 ft. high and weighs more than 200,000 lb. Its product is largely used for bottling spring water, pharmaceuticals, fruit syrups, etc., and because of its convenient size it is becoming of increasing interest to the chemical industries.

Electric Heating Helps to Make Better Glass Bottles

By Sidney D. Kirkpatrick
Associate Editor, Chem. & Met.

AUTOMATIC machinery, by making possible the methods of continuous quantity production, greatly improved and simplified the manufacture of glass bottles. But this speeding up of operations also introduced many practical engineering problems and this is particularly true in the case of the larger sized wares. The Illinois Glass Company, at its Alton plant, has long specialized in the production of 5-gallon bottles or carboys, which are the largest now made commercially in automatic machines. Bottles of this size, as well as the larger carboys used by the chemical industry, were formerly made entirely by hand, and were then placed into brick annealing kilns which were sealed up, fired to a fairly high temperature and allowed to cool gradually over a period of a week or more. Obviously such methods could not readily take care of the output of an automatic machine capable of turning out 7,500 to 8,000 big bottles per 24 hours. Furthermore, close control of temperature was impossible in the old kilns and the inadequate annealing did not always give the even strength required in the finished product. Machine production, therefore, demanded continuous annealing and to do this efficiently meant doing it in the shortest possible time consistent with exacting maintenance of proper temperature conditions.

In the Alton plant the practical solution of this problem was found in the application of electric heating in long, well-insulated tunnel lehrs through which the product was carried on a continuous steel belt. Sufficient electric heat is provided to give the proper temperature gradient and by means of Leeds & Northrup potentiometer type, base-metal couple thermostatic controls, each section of the lehr is maintained at its proper temperature. Nichrome elements are used in the larger lehrs, although non-metallic (carborundum) resistors are used in the lehrs for the smaller ware. Since maximum temperatures are no higher than 1,000 deg. F., the resistors have long life.

Although the unit cost of the electric heating was much higher than for oil or gas firing, the more efficient utilization and precision of control, unobtainable by any other means of heating, actually made the process more economical. Even greater savings resulted from consistently good annealing in such greatly reduced time.

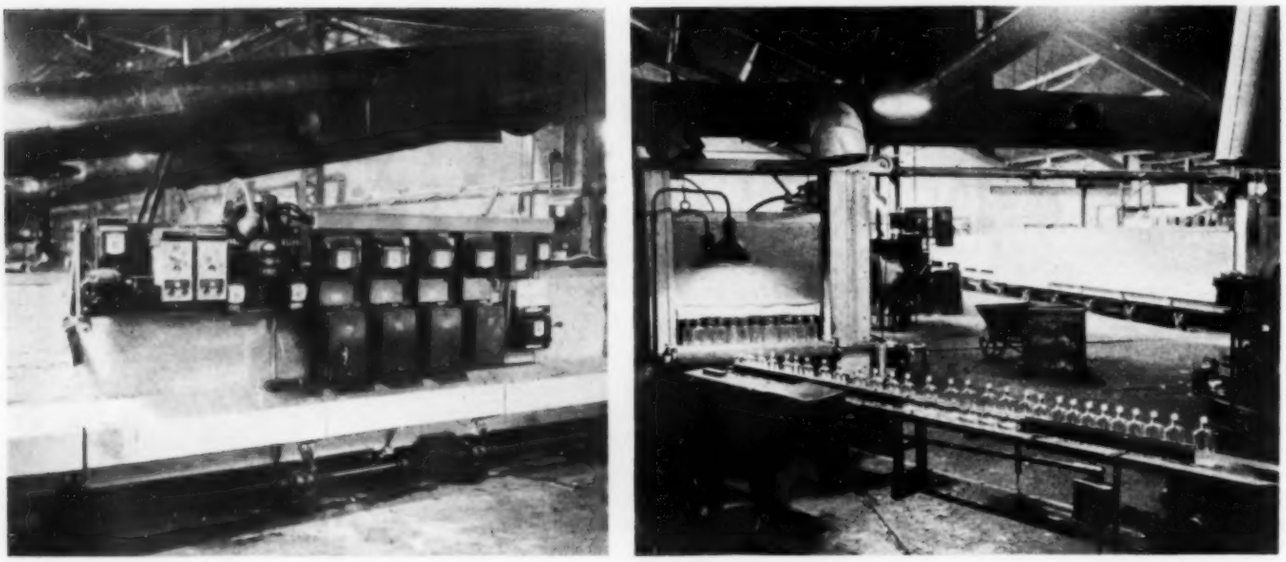
AFTER the difficult annealing problem of the big bottle machine had been solved, the same method was then applied to the smaller wares. The older types of continuous gas-fired lehrs were immense affairs, 10 or 15 ft. wide and 70 to 80 ft. long, constructed of fire brick, supported by heavy steel members. The newer electric heated lehrs, although of approximately the same length are but 4 or 4½ ft. in width and are of light-weight construction throughout. A 2-lb. insulating brick takes the place of the heavy refractory necessary to withstand the higher temperature which in the firebox might reach 3,000 deg. F. Being so constructed it was possible to put the lehrs on wheels so that they could be brought up as close to the forming machine as desired. This meant more flexible operation and was a decided advantage in the elimination of carry-in labor and conveyor equipment, and better utilization of the original heat in the ware. Further than this, it insured an efficiency in tempering the bottles, not otherwise obtainable, through more exact temperature control and by eliminating the lapse between the time the ware was ejected from the machines and the time it went into the lehrs. The "flivver lehr" as it is popularly called, represents one of the outstanding developments in the glass industry during the past few years.

ILLINOIS Glass Company, with plants at Alton, Bridgeton, N. J., Gas City, Ind., and Chicago Heights, Ill., has a daily capacity of approximately 3,000,000 glass bottles. The Alton plant, which produces about 1,400,000 bottles in a day, has 10 continuous tank furnaces and 35 automatic bottle machines of which 22 are vacuum-feed, and 13 are of the gob-feed type. Daily fuel consumption in this plant alone is 310 tons of coal and 18,000 gal. of fuel oil. Producer gas from 10 producers is used in the melting tanks and additional rich gas of 1,300 B.t.u. is available from the cracking stills of 3 nearby oil refineries.

The machine which makes the large 5-gal. bottles is the largest of all bottle-blowing mechanisms. It stands 32 ft. high and weighs 210,000 lb. Its product is largely used for bottling spring water, for pharmaceuticals, fruit syrups, etc., and is of growing interest to the chemical industry. Although less than half the size of the standard 12-gal. carboy, it has important advantages in strength, in ease of handling and in packing for shipment. It is a convenient sized unit for many operations and will doubtless be more widely used by chemical manufacturers where favorable shipping conditions permit.

In all of the plants of the Illinois Glass Co., the principal ingredients for the glass batch—sand, lime, soda ash—are stored in large circular concrete bins. Electrically operated weighing trucks such as are illustrated on page 278 are used to collect the proper quantity of each material and to dump it into the batch mixer. From these the batch is elevated to an overhead loading bin which discharges by gravity into the cars that transport the batch to the furnaces.

The continuous tank furnaces at the Alton plant are of standard construction. Each is divided into two compartments by means of a refractory bridge wall. In the larger compartment the raw batch is melted into glass



Two of the "Flivver" Type Electric Heated Annealing Lehrs That Have Replaced the Heavier and Less Efficient Fuel-fired Types

which flows through an opening in the bottom of the bridge wall into the refining end of the furnace where it is maintained at an average working temperature of about 2,700 deg. F. Slag and unmelted portions of the batch remain in the melting chamber. If the furnace supplies a vacuum-type machine, the glass flows from the refining end into an open clay revolving pot from which the glass is sucked by the machine. With gob-feed machines, the glass passes through the refining chamber into the fore hearth where it is cut into gobs by the machine feeders. A furnace of average size holds approximately 250 tons of molten glass and will produce from 35 to 50 tons of finished product per 24 hours.

Reference has already been made to the two types of automatic bottle-making machinery in use in the Alton plant. The difference in these machines lies primarily in the method of gathering the glass and getting it into the forming mechanism. The vacuum-type machine consists of a rotating base on which there is a central column holding six or more arms that revolve about this axis. To each arm is attached a blank or measuring mold and as the machine revolves the mold passes over the surface of the molten glass in the furnace pot and a definite quantity is sucked into the blank mold. As the machine continues its revolution, a metal tip is lowered into the mold to form the neck of the bottle, then the blank mold opens and falls down and while the glass is held firmly by the neck, the finishing mold rises and closes about the white hot glass. Air pressure is applied through the neck tip mechanism and the bottle is blown to conform to the exact size and shape of the blow mold. Uniform air pressure assures even distribution of the glass throughout the bottle which accounts for the increased strength and uniform capacity of machine-made bottles. With one complete revolution, a finished bottle is made and dropped automatically into the receptacle in which it is carried to the annealing lehr. The machine making 5-gal. bottles turns but five-sixteenth of a revolution per minute, while the one producing half-ounce bottles speeds along at a rate of 8 revolutions per minute.

In the vacuum process the machine was brought to the furnace. In the gob-feed type the glass is brought to the machine. In this machine compact chunks of glass of the desired shape, size and consistency are cut from a feeder attached to the furnace and these gobs slide by gravity down a trough system into the blank molds of the machine below. Forming operations in the machine are similar to those already described for the vacuum type.

ANNEALING has already been referred to as one of the most important steps in the bottling manufacturing process, and unusual care is taken to maintain precise control of the time and temperature of cooling. It is only in this way that the strains that develop in manufacture and cooling can be eliminated. The bottles leave the machine at about 1,100 deg. F., and this heat is tapered off very gradually during the first "soaking" period. After a certain critical temperature has been reached, the product can be cooled at a comparatively rapid rate. In addition to the temperature control in the different sections of the lehr, the time of passage is determined by the speed of the conveyor and this is varied with the size and style of bottle. In general, the smaller ware are put through the lehr at a much more rapid rate and at somewhat lower temperatures than is the case with the larger bottles. In all cases the bottles leave the lehrs cooled to proper temperature for inspection and packing. The Illinois Glass Company, incidentally, makes its own wooden and fiber boxes.

From this necessarily brief description the reader may receive the impression that glass bottle manufacture is a comparatively simple and standardized mechanical operation. This is far from true, however, because few industries involve more fundamental application of heat technology and the correlation of this knowledge with mechanical and chemical engineering processes. For example, the composition as well as the temperature control of the glass at the time it passes to the machines is extremely important since its consistency must be varied to meet the requirements of each type of product. There is a spread of as much as 400 deg. F. between the working temperature of the glass used for half-ounce bottles and that for 5-gal. carboys. Control of pot and furnace temperatures, adjustment of speed of revolution of the machine, the setting of the vacuum control, the regulation of chill, puff and blow controls, and the maintenance of the proper temperature gradient in the lehrs are but a few of the many variables that make glass bottle manufacture a truly scientific, and to a large extent, a chemical engineering industry.

Electrochemical Society Holds Spring Meeting in Bridgeport

Chemical production of electricity, industrial electric heating and electrodeposition are chief topics

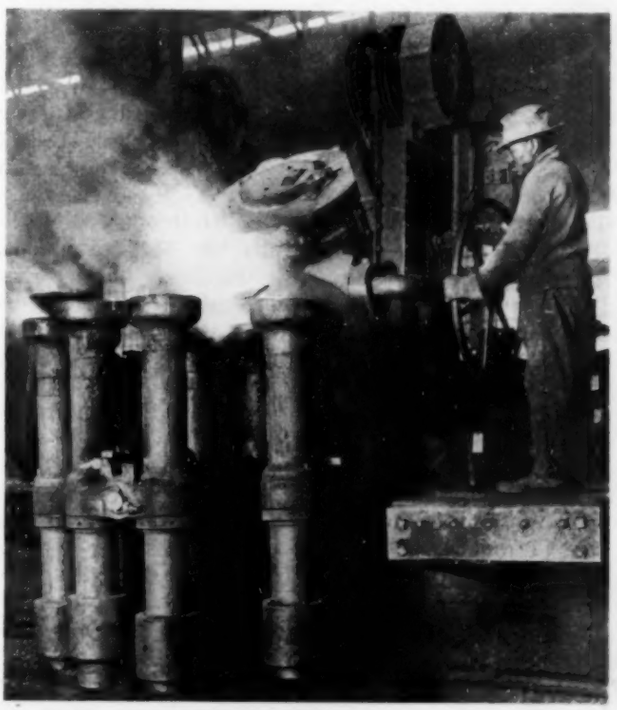
Editorial Staff Report

BRIDGEPORT bids fair to become one of the most important electrochemical centers in the country. There is more electric brass produced in Connecticut than anywhere else in the world and many of the largest plants for the electrodeposition of silver, brass, gold, nickel and chromium are located within a short distance of Bridgeport. Accordingly, it was not surprising that the convention of the American Electrochemical Society, held April 25 to 28, attracted over 350 chemists and engineers.

The papers which were presented were naturally divided into three groups, one of which formed the topic of each of the three days' discussions. The first was concerned with the chemical production of electricity. The second session was held jointly with the National Electric Light Association and dealt with industrial electric heating. The final session was given over to electrodeposition. A number of social features, the presidential address, the annual business meeting and election of officers and several plant trips rounded out the proceedings.

THE symposium on chemical production of electricity included in its scope primary batteries, storage batteries, standard cells, electrolytic rectifiers and electrolytic condensers. George W. Vinal, physicist and battery engineer of the Bureau of Standards, was largely responsible for the excellence of the program of this symposium and presided during both sessions. In his opening address, Mr. Vinal, traced the early history of the production of electricity, touching briefly upon the experiments of the Bishop of Pomerania (1745), Galvani (1786) and others, emphasizing in particular the importance of the researches of Volta, forming as they do the foundation of all of our later battery developments. Within nine years following Volta's announcement of his pile, the Royal Institution was equipped with a powerful battery of 2,000 cells. The brilliant experiments and discoveries of Davy, Ampère, Oersted, Ohm, Faraday and others came in the succeeding years. Daniell's gravity cell (1836) overcame the difficulties with polarization common with Volta's cells. Then followed the Grove, Bunsen, Leclanché, Lalande and a host of other cells. The first practical storage battery was that of Planté in 1859. In 1909 the United States produced 23,000,000 pounds of storage batteries and in 1925 388,000,000 pounds. Similarly, the dry cell output of the United States grew from 5,000,000 cells in 1904 to 531,000,000 in 1925.

THE first paper, that of C. A. Gillingham, works manager for the National Carbon Company at Cleveland, made certain comments on dry cell tests and service. The author stressed the desirability of having the individual test conform as closely as possible to the actual service to which the cell is to be put. Tests must take into account the three primary actions occurring in the cell: (1) chemical depolarization; (2) mechanical depolarization; and (3) shelf reactions. Following this Professor Farrington Daniels of the University of Wisconsin presented the results of his studies of the physical aspects of the Leclanché dry cell. He found that the energy of a 90-gram "D" cell is equal to almost 13,000 watt seconds. The pH of the solution of the cell is the chief factor in determining the voltage of the cell. The accumulation



High Frequency Induction Furnace at the Plant of the Bridgeport Brass Company

of ammonia constitutes the most serious problem in the operation of the dry cell.

ERNEST Jegge, Technical Director of the Société Anonyme Leclanché, of Yverdon, Switzerland, took exception to statements made by Professor Daniels and others and was undoubtedly one of the most enthusiastic participants in the symposium. He vigorously addressed the authors in French, German and finally in English. He has invariably found an increase in cell capacity of about 10 to 15 per cent (in some cases even 25 per cent) after several months of shelf life. He believes that manganese dioxide is not a simple compound represented by the formula MnO_2 but that it is a highly polymerized compound of which certain manganese atoms may be more readily hydrated than others. F. A. J. Fitzgerald of Niagara Falls suggested that the differences in shelf test found by American investigators and Mr. Jegge might be attributed to the lower storage temperatures used in Switzerland. H. Swan of New York maintained that the MnO_2 must be absolutely chemically pure to yield good conductivity. M. L. Martus of Waterbury discussed the possibility of getting reversal of polarity under certain conditions.

THE next paper, given by Mr. Jegge, discussed adsorption phenomena in primary cells. These are most fundamental and a thorough understanding will lead to great improvements in dry and other cells. Montana manganese dioxide ore is preferable to that from other sources because of its high adsorption qualities. Professor Daniels felt that Jegge had overemphasized the importance of adsorption phenomena. There are other factors that seem to have more influence on the quality of the cell. W. C. Moore, chief research chemist of the U. S. Industrial Alcohol Company suggested that further studies seem advisable.

T. J. Martin and A. J. Helfrecht of the C. F. Burgess Laboratories, Madison, Wis., determined the potentials of manganese dioxide in electrolytes of various hydrogen ion concentrations. Their data show that there is a considerable variation in the potential of manganese dioxides from various sources and that each one has a fairly constant potential over a wide range of pH values for the electrolytes. In discussion, M. R. Thompson of the Bureau of Standards felt that the differences were due largely to different grain sizes. E. Jegge likewise questioned the results of Martin and Helfrecht. He suspected that their potential values had not had time to reach true equilibrium values. Professor Daniels had made his measurements on thin coatings of MnO_2 deposited on platinum wires and probably came very close to equilibrium values, although W. Blum of the Bureau of Standards questioned even Daniels' values since it is difficult to control the composition of the manganese dioxide deposits on platinum.

THE second Burgess Laboratory paper dealt with the gelatinization of corn starch in dry cell electrolytes. Zinc chloride acts upon the starches producing a hardened mass with little coherence in the case of the lower concentrates, and producing a yellowish sticky mass in case of the higher concentrations. E. Jegge emphasized the complications involved, as different qualities of corn starch tend to produce variations in results obtained. J. G. Zimmerman, also of the Burgess Laboratories, the next speaker, discussing rapid dry cell testing, showed that one rapid discharge of a cell would supply data for the prediction of performance of other cells. Three further papers likewise covering Burgess Laboratories researches concerned graphitic oxide as a new depolarizer. B. K. Brown reported that the laboratories had found that graphitic oxide could be used as a depolarizer either to supplant or to supplement MnO_2. O. W. Storey, speaking on graphitic oxide and the Brodie reaction emphasized the necessity for a careful technique when using the Brodie reaction. Brown and Storey together described the electrochemical production of graphitic oxide. Graphitic carbon may be oxidized to a deflagrating oxide of carbon, having the properties of graphitic oxide, when used as anode in a neutral or an acid electrolytic bath containing an oxygen-containing oxidizing anion.

IN the discussion of the three graphitic oxide papers, Mr. Jegge inquired regarding the initial open circuit voltage drop of the new cell from 1.5 down to 1.3 volts. Mr. Storey advised that no satisfactory explanation has as yet been found. V. A. Kostjejev of Zagreb, Yugoslavia, attributed the fact that in a graphitic oxide cell less NH_3 is evolved rather to the high capacity of the precipitated carbon to absorb the gas than to the absorbing capacity of the graphitic oxide itself. Charles F. Burgess reviewed briefly the interesting research on graphitic oxide and demonstrated a number of the new batteries. F. A. Lidbury of Niagara Falls inquired whether perchlorate had ever been tried as a depolarizer.

Marion Eppley of the Eppley Research Laboratory, Newport, R. I., opened the afternoon session with two reports of studies on the Weston cell, discussing improvements in the technique of setting up standard cells and also the cathode equilibrium in the cadmium standard cell. In the former he mentioned the use of atmospheres of pure nitrogen and hydrogen, replacing air, in obtaining uniform results. In the second he found the equilibrium to be different if mercury be omitted. Mr. Vinal, discussing Dr. Eppley's reports pointed out that it has been a mystery for years how it was possible that the standard cells at the various government laboratories should agree so closely with one another. The difference between the British and the U. S. standard is but 0.00001 volt.

M. L. MARTUS, president and general manager, the Waterbury Battery Co., gave an account of the modern Lalande battery. He submitted detailed information on the effects of temperature and variations in the concentration of the electrolyte. An insufficiency of caustic soda in the electrolyte will result in a cell of low capacity. This is true for all temperatures. The life is greater at low temperatures than at high. R. W. Erwin referred briefly to caustic soda cells using a small quantity of a catalyst.

W. E. Holland of the Philadelphia Storage Battery Co. described a commercial aluminum electrolytic rectifier developed at his laboratory. The electrolyte, an aqueous solution of ammonium and potassium phosphates with a small amount of either malic or citric acid, has a much greater capacity for holding aluminum in solution than older types. Aluminum containing a little copper makes the best cathode. Current delivery and life fall off rapidly as the copper content drops below 0.05 per cent. The anode of the new rectifier is of ferrosilicon.

The operating characteristics of the aluminum electrolytic condenser were reviewed at length by H. O. Siegmund of the Bell Telephone Laboratories. There

are two common conditions affecting the life of the aluminum condensers that must be controlled. (1) The chemical action of the electrolyte on the electrodes and the film, and (2) the corrosion of the anodes. An ammonium borate solution having a specific resistance of 225 ohms per cu.cm. has proved to be satisfactory. In answer to F. A. Lidbury's question as to the thickness of the film on the aluminum electrode, Mr. Siegmund stated that this was of the order of 10^{-5} to 10^{-8} cm. having a dielectric constant which he said was about 80 times that of air.

G. W. VINAL and C. L. Snyder of the Bureau of Standards determined temperature effect and other factors on the performance of storage batteries. It was found that the temperature effects are less for the higher concentrations of the electrolyte in the case of positives, whereas the reverse is true for the negatives. Under extreme conditions, as in airplane service, the negative plates are likely to become the limiting factor in determining the capacity. The best concentration of electrolyte for use in batteries under extreme conditions is a compromise between the requirements of the positive and the negative plates. The change in capacity with temperature, when the capacity is limited by the positives, is inversely proportional to the changes in viscosity of the solution.

L. Jumau, Technical Director of the Compagnie Générale d'Electricité in discussing the theory of the lead storage battery took exception to Fery's assumption of the existence of the oxide Pb_2O_5 in the charged positive plate. He showed that the "double sulfation" theory accounts fully for the reactions taking place in the lead battery.

Sakae Makio of the Electrotechnical Laboratory, Ministry of Communications, Tokio, Japan, submitted two papers. The first dealt with the drying and storage of secondary battery plates in the charged state. He found that plates preserved according to his system may be kept at about 79.4 per cent of rated charge. In Makio's second paper he describes the use of the mercurous sulphate electrode for testing storage batteries. The potential of the electrode was found to be 0.675 volt on the hydrogen scale with a temperature coefficient of —0.00026 volt.

THE Friday morning session was devoted to industrial electric heating. R. M. Keeney of the Connecticut Light & Power Co., described at length the annealing of non-ferrous metals in the electric furnace, illustrated with several motion picture films of furnaces in actual operation. R. H. Leach of Handy & Harman presented data on the melting of silver in the Ajax-Northrup high frequency furnace and C. M. Hoff of the Grasselli Chemical Company traced the development of a process and equipment for the manufacture of chemically pure acids by electrical distillation. It seems that a better method for the manufacture of chemically pure hydrochloric acid was desired. Efforts were directed toward developing a continuous process, employing first fuel heating and later electrical energy for distillation. The paramount difficulty was the obtaining of materials of construction that would meet all the requirements. The result of this work is a continuous process that utilizes electrical energy in place of fuel, reduces greatly the operating costs and breakage, advances the quality of the product, and improves the working conditions. This process and apparatus are also adapted to the manufacture of chemically pure nitric acid, introducing additional problems in the selection of materials of construction. Hoff's paper drew forth voluminous discussion in which Messrs. Winship, Fitzgerald, Miller, Brockman, Blum, Fink, Skowronski and Styer participated.

AFTER this, V. J. Sweeney of Pennsylvania State College discussed the fundamental corrosion reactions of iron in the absence of oxygen and the iron-ferrous ion-hydrogen ion-hydrogen equilibrium from an electromotive and free energy standpoint. The conclusion is drawn that there is a small free energy decrease for the attack of iron by water to form ferrous hydroxide and hydrogen even in the absence of oxygen.

Concluding the session on Friday, a paper by J. R. McKey, C. A. Mann and G. H. Montillon of the University of Minnesota, was presented, covering research into the conductivity measurements of solutions of 18 inorganic salts in pure furfural containing a small amount of pyrogallol as a stabilizing medium. The halides gave the best results, and of these the iodides of potassium and ammonium were the most satisfactory. Quantitative measurements confirmed these conclusions. Mixtures of cuprous iodide with ammonium or potassium iodide in furfural gave increased values. Zinc iodide behaved similarly. Copper, zinc and silver were plated from solutions of the metal iodide with ammonium iodide in furfural. W. C. Moore of Baltimore, commenting on this interesting research, suggested that the presence of pyrogallol should not be lightly considered, as it might materially affect the polarization values. Professor Brockman of Georgia reminded the audience of the difficulty of finding organic compounds that are ionizing liquids and urged that a further study of furfural be made.

THE last day's session saw Prof. E. M. Baker of the University of Michigan presiding in the chair. The introductory paper was on electrodeposition of thallium, written by Prof. O. W. Brown and Sister Amata McGlynn of Indiana University and St. Mary-of-the-Woods College, respectively. Smooth, coherent deposits were obtained with a perchlorate bath (80 to 160 grams per liter of thallium chlorate plus perchloric acid) using peptone as an anodic depolarizer, cresylic acid as an addition agent and current densities of 0.5 to 1.8 amp. per sq.dm. C. G. Fink, in discussing the paper referred to his experiments on the deposition of thallium on lead with subsequent heat-treatment, producing a surface alloy of the two metals more resistant to acid attacks than either metal alone.

A PAPER which aroused much interest and favorable comment was that of H. K. Work of Mellon Institute on electroplating on aluminum and its alloys. Mr. Work displayed a large number of samples of nickel and chromium plated on aluminum that were perfectly adherent and remarkably resistant to corrosion. Plating on roughened aluminum surfaces is recommended as a practical procedure. Nickel appears to be the most workable metal for the foundation coat. It is found that a pH of 6 gives good results. In general, any nickel bath that operates satisfactorily for zinc is acceptable for use on aluminum. Proper preparation of the surface of the work is most essential and full details were given regarding the best "dips" and cleaners to use.

A photomicrographic study of rough or nodulized electrodeposited nickel, undertaken by Profs. C. Upthegrove

and E. M. Baker, University of Michigan, was next described. This study showed that the nodules are apparently not related to imperfections in the base upon which the plating is done nor to the method of cleaning, as the nodulized growth may start after metal has been deposited to some thickness. In general, it is believed that the nodules are a result of suspended particles in the bath which may come in contact with the surface of the metal after deposition has started. The indicated remedy, therefore, is the maintenance of more nearly clear solutions. The discussion that followed was particularly concerned with the question as to whether or not the suspended particles were metallic or non-metallic. Opinion favored the latter.

W. BLUM and J. H. Winkler of the Bureau of Standards and the International Association of Electrotypers respectively submitted two papers on electrotyping. Tentative specifications for electrotyping graphite were developed. A recommendation as to a suitable solution for use in depositing nickel upon graphite wax molds was also made.

The four concluding papers of the session were concerned with the electrodeposition of chromium. R. Schneidewind and S. F. Urban of the University of Michigan found that the trivalent chromium concentration is affected by the following variables, which may act by their effect on the oxygen overvoltage, or by other means: (1) Anode material; (2) Anode current density; (3) Composition of bath; and finally, (4) Temperature of bath.

PROF. H. S. LUKENS, University of Pennsylvania, reported research on the influence of the cathode on the electrodeposition of chromium and observed that the maximum amount of trivalent chromium is produced at low current densities, the least amount with nickel, a greater amount with copper and the greatest amount with lead. The minimum amount of trivalent chromium is produced at high current densities. Of the three cathode metals, nickel, copper and lead, copper yields practical deposits over the widest range of current densities, nickel over the narrowest range. The effects observed with the three metals are probably related to their respective hydrogen overvoltages and the rapidity with which the metal surfaces become covered with chromium. While hydrogen overvoltage is influenced by current density and temperature changes, typical overvoltages for the three metals may be expressed as nickel, 0.18 volt; copper, 0.35 volt; lead, 0.45 volt.

THE effect of trivalent chromium and iron on chromic acid plating baths was reported by R. Schneidewind, S. F. Urban and R. C. Adams, Jr., of the University of Michigan. In baths containing chromic acid and sulphate ion, bright deposits having a thickness of 0.0007 mm. (0.00003 in.) or less are obtained on copper between limits corresponding roughly to 5 per cent and 20 per cent current efficiencies. In cases of other metals the range of current efficiencies yielding bright plate may be narrower. Heavy deposits on all metals are best obtained at 12 to 14 per cent current efficiency. Other things equal, increasing the concentration of trivalent chromium and iron does not appreciably change the relationship of current density to current efficiency. However, the range of current densities producing bright plate is markedly contracted.

Finally L. E. Grant and L. F. Grant of the New Departure Co., reported on a study of the hardness and structure of deposited chromium. They found that the hardest deposits were obtained at relatively high current densities. The presence of a network of cracks in some chromium deposits may be one cause why these deposits do not protect the base metal from corrosion.

THE CHROMIUM papers were discussed by Messrs. Smith and McLease of the Chromium Corporation, Seede of the General Electric Co., Hoff, Blum, Fink, Wood of New Britain, Phillips of the General Motors Corporation, Herzog of the Union Carbide Co., Hambeuchen, Brockman, Baker, Proctor, Brown of Cleveland, Mesley of the Oneida Community, Ltd., and by others.

In addition to the papers which have been reported above, other features included the large public meeting held Thursday evening, April 26. Engineers and scientists from nearby regions attended in force. The presidential address by Prof. S. C. Lind was based upon the epoch making experiments of Lind and his associates at the University of Minnesota, and dealt with the theory of chemical action in electrical discharge. In his own summary of his remarks, Dr. Lind says: "To review the two theories more generally, it would appear that if enough energy has already been expended to produce ions, a very large amount of latent energy is possessed by the ions, so that they need no additional kinetic energy to make them reactive toward other molecules. The only way to disprove this by energy considerations would seem to be by showing that a larger amount of action is accomplished than can be accounted for on the cluster theory.

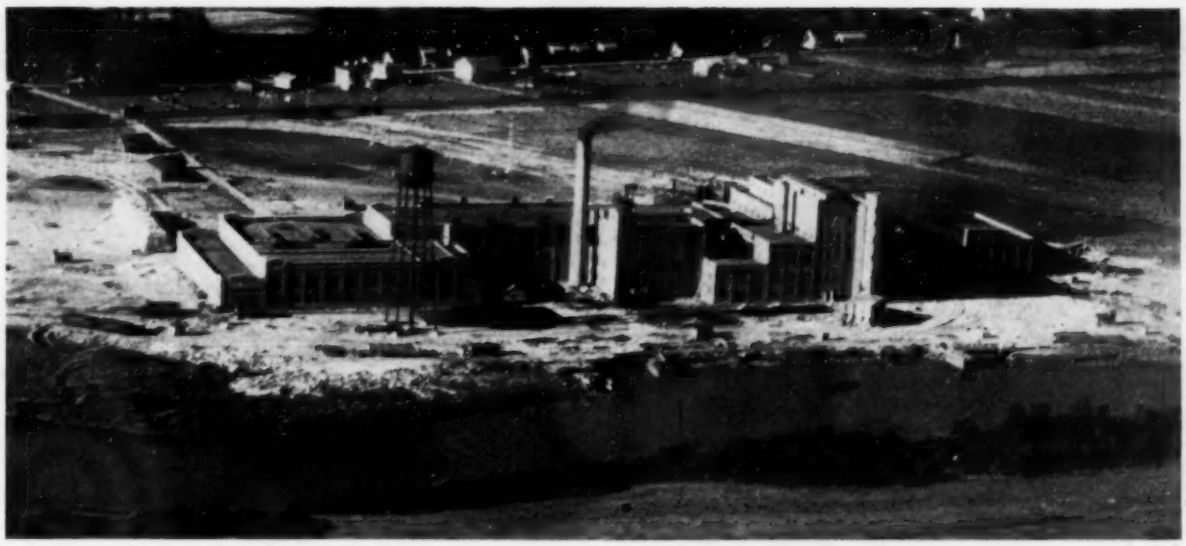
"This involves evaluation of the proportionality factor which for electrical discharge has not yet been done and, as we have seen, cannot be accomplished until the ionization can be determined. But if we may reason by analogy from the α ray results, static ions without any kinetic energy (resulting from a field) are quite sufficient, and the yields found do not exceed the possibilities of clustering. That the α ray results for the hydrocarbon gases may be applied by analogy to the chemical action of *electrical discharge* in the same gases has already been discussed."

DR. BERGEN DAVIS of Columbia rounded out the meeting with an address on refraction of X-rays in elements and compounds and described the researches conducted at Columbia. Among other things Davis demonstrated how some of the new findings might assist in the determination of size of grain in fine powders.

The Local Committee under the very efficient guidance of J. L. Christie of the Bridgeport Brass Company, arranged for a large variety of entertainment. The induction furnaces of the Bridgeport Brass Company were inspected together with brass, silver and nickel plating at P. & F. Corbin Company and gold and silver plating at the plant of the International Silver Company. In addition, visits were made to a number of other plants of the vicinity.

EDITOR'S NOTE:—*Announcement of the new officers of the Electrochemical Society is made in the News Section of this issue together with a notice concerning the fall meeting to be held at Charleston-Huntington, W. Va.*

The paper by C. M. Hoff, on the electrical distillation method for the production of chemically pure acids will be abstracted in considerable detail in an early number of Chem. & Met.



Modern Engineering Answers the Call for Lower Costs in Newsprint

By A. E. Buchanan, Jr.
Assistant Editor of Chem. & Met.

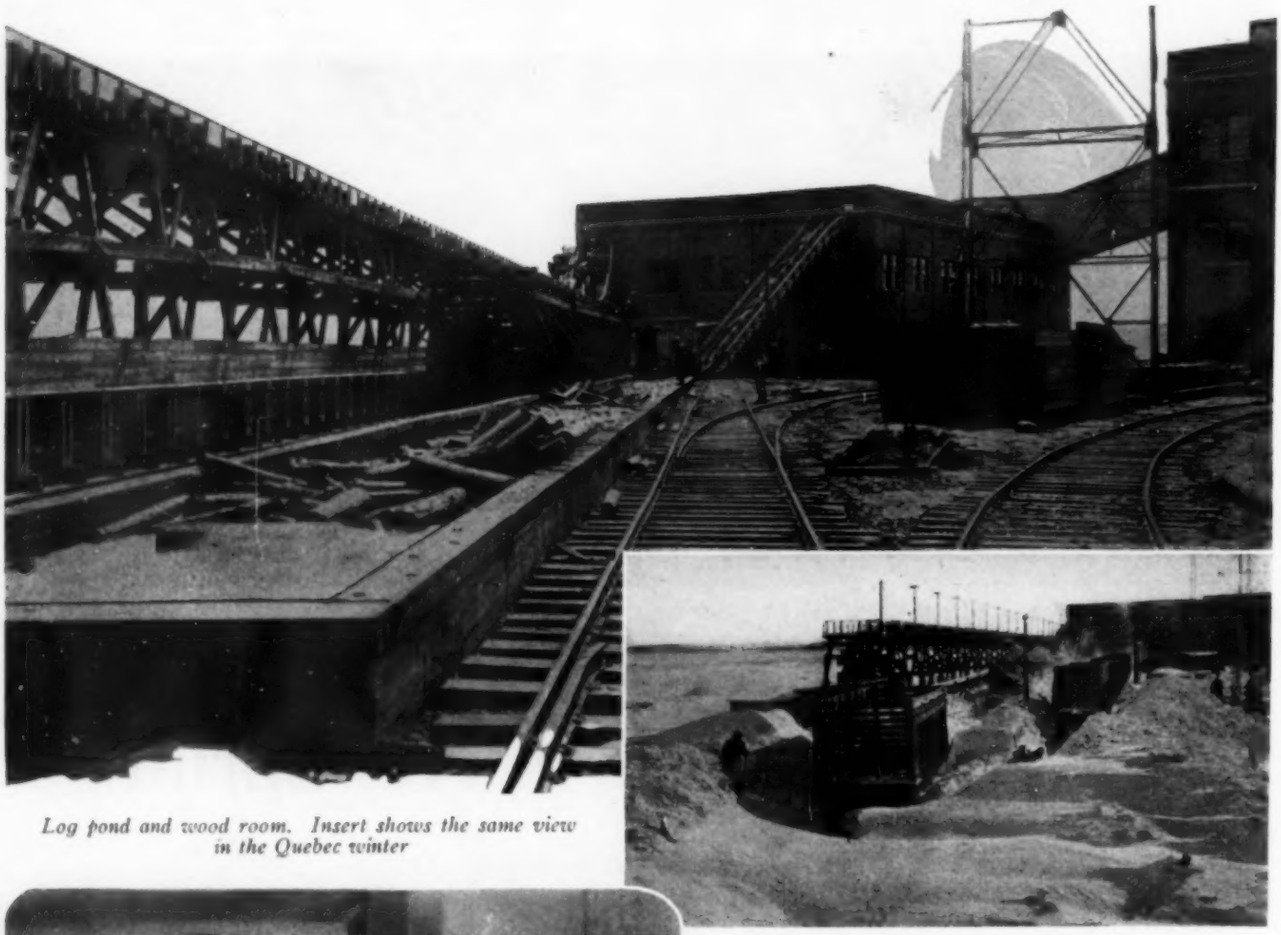
Designed and built to operate profitably in a period of close competition, the mill of the Ste. Anne Paper Company, Ltd., at Beaupré, Quebec, exemplifies the answer of the chemical engineer to the demand for lower production cost and high quality. Skillful design and modern equipment, combined with practical experience produced this splendid plant.

PRACTICAL! That is pre-eminently the word which characterizes the new mill of the Ste. Anne Paper Company, Ltd., at Beaupré, Quebec. Designed and built specifically to operate profitably during a period of close competition in the newsprint industry, this plant is a model of skillful design and sound engineering against a background of long, practical papermaking experience. An inspection of the mill recalls the conception of engineering as "making a dollar yield its utmost," for dollars were obviously lavished or saved with one end consistently in view — lowest production cost consistent with quality.

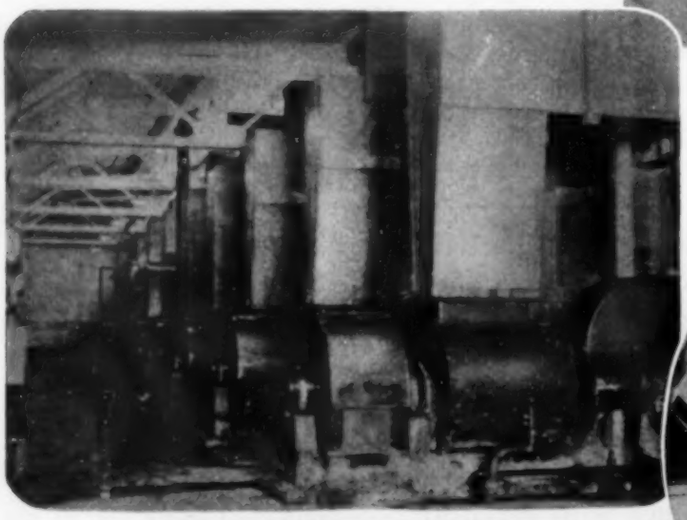
Sequestered in the beautiful, rugged valley where the Ste. Anne joins the St. Lawrence River, twenty-five miles below the city of Quebec, the Ste. Anne mill is a unit in one of the great Canadian newsprint companies, formed recently by the consolidation of the Abitibi Power and Paper Company and the Spanish River Paper Company interests. The resources of this parent concern are said to total $180,000,000 and its productive capacity is close to 1,000,000 tons of newsprint per year. The two machines of the Ste. Anne mill are producing 240 tons per day at present, at a speed of 950 feet per minute. Since the machines are designed for speeds up to 1,400 feet, their ultimate capacity should be well over 300 tons of paper per day.

Pulp wood in 4-ft. lengths is floated from the Company's timber limits, down the Ste. Anne River to a dam, about 1½ miles from the mill, where it is stacked, to be delivered to the mill by rail in specially designed cars. A stack of some 800 cords of blocks is kept close to the wood room and adjacent to the log pond, into which the cars discharge. This "pond" is a long concrete trough, 7 ft. deep, filled with water which is kept flowing toward the wood room by a large circulating pump. The blocks thus float to the end of the pond on to a log haul, 120 ft. long, which carries them up an incline to the wood room.

In this building, connected with the mill only by the conveyor bridge, the blocks are prepared for both the mechanical and chemical pulping processes. Dropping into the rotating steel drum, 12 ft. in diameter and 45 ft. long the blocks are tumbled under heavy water sprays to remove bark and to wash them, after which they are discharged to the sorting conveyor which is 120 ft. long and comprises 9 parallel chains. Those destined to become groundwood pulp proceed unmolested over the bridge to the block bins above the grinders; those for the sulphite mill are switched off and fall into the 84-in. Waterous chipper. Belt driven from a 100-hp. motor,



Log pond and wood room. Insert shows the same view in the Quebec winter



Left— Battery of Bird screens

In circle—American filters thickening groundwood and sulphite pulp

Left—Finishing room and offices

this machine converts 8 to 10 cords of logs per hour into chips about the size of a half-dollar. A second chipper was being installed at the time of the writer's visit (March 30, 1928). A belt conveyor under the chippers conducts the chips to a bucket elevator which feeds a double screen, inclined and shaken by a motor and eccentric, wherein the oversize chips and sawdust are removed. The former are conveyed to a rechipper, returned to the screen and thus eventually join the good chips which are elevated to the bridge to board the long belt conveyor for the chip bins above the digestors in the sulphite mill.

Chip and blocks thus travel on their respective conveyors up the 240 ft. bridge to the top of the main mill building, where the former turn left on a transverse belt to the sulphite mill, and the latter go off to the right and are distributed to the block bins in the groundwood mill. The block bins are constructed of heavy timber sides, the bottom being the charging floor above the grinders, so that blocks discharged from the bins can be tumbled directly into the grinder magazines as shown in Fig. 1. Charging doors are hinged and counterweighted and the steam formed by the heat generated in grinding which rises, fragrant with resins, from the stone, is drawn off from the upper part of the magazines. This room, like the grinder room proper, is ventilated by a large fan and long air ducts, visible in the photograph. It is light and airy as all the rest of the mill and thus presents a pleasant contrast to the misty atmosphere common to some older groundwood mills.

TEN grinders, driven in pairs by 2,600-hp. motors reduce from 180 to 200 cords of blocks per day to mechanical pulp. The stones used measure 67 in. in diameter and 54 in. wide. Blocks are fed down to the stones from the magazines by means of a sturdy caterpillar-like belt which moves slowly down the inside walls of the magazines, gripping the blocks and forcing them against the stones. Fig. 2 shows these belts, two on each side of the magazine, the exposed portion being, of course, the return or "up" side of the feeder caterpillars. The photograph also shows the housing over the gears driving these belts, and mounted above it the little motor which, thanks to the very high reduction ratio is sufficient to drive the caterpillars, although their movement is hardly perceptible. This type of grinder is made by the Continuous Wood Grinder Company, Ltd., of Montreal.

Of peculiar and somewhat flattering interest to the chemical engineer is the fact that two of the grinders were equipped with synthetic grind stones, carborundum having been adapted to replace the natural sandstone so long standard. These stones are built up of interlocking carborundum slabs, permanently mounted on a steel drum core. Their resistance to wear is considerably greater than that of the natural stones and their satisfactory performance at this mill is indicated by the fact that the two additional grinders now being erected are to be equipped with these Norton stones.

PULP from the grinders is flushed down a trough under the machines leading to the bull screens. These rotating cylinders of perforated metal pass everything except the large slivers of unground wood which are retained and discharged to the sewer. The pulp is pumped to a battery of Bird screens located just below the American filters in the mixing department. Here again, the pulp suspension flows into the center of a rapidly rotating cylindrical screen, the long fibers being retained and the good pulp passed to the filter chests. Six such centrifugal screens handle the output of the grinders, one of them operating on the tailings from the other five. The Bird screens, being equipped with vanes, act also as centrifugal pumps, throwing the screened pulp up the flumes, to the American filters, located on the floor above. There are four of these continuous vacuum filters thickening the groundwood pulp to a cake of about 10 per cent consistency, i.e., 90 per cent water. Each filter unit comprises 10 disks, covered with 60-mesh wire and operated at 15 to 17 in. vacuum. The matted cake is stripped from the screens by rotating rubber scrapers and drops to the groundwood stock chest, a concrete tank measuring 67 by 30 ft. and 16 ft. deep, with a capacity of 32 tons of 3 per cent pulp suspension.

Returning to the sulphite mill, it will be recalled that the chips from the wood room are dumped in bins above the digesters, each bin holding about 35 cords of chips. A hopper runs on rails below the bins for charging. There are two digesters, 16 ft. in diameter and 54 ft. high, with ample space for a third when needed. They are built of riveted steel sections, lined with acid-proof tile and are housed in a high, well-lighted brick-walled room, completely visible and accessible. As a safety measure, the digester steam lines are equipped with blow-off valves discharging outside the building. Recording instruments in the digester operating room register the temperature and steam pressure throughout the cook and periodical samples of cooking acid are tested.

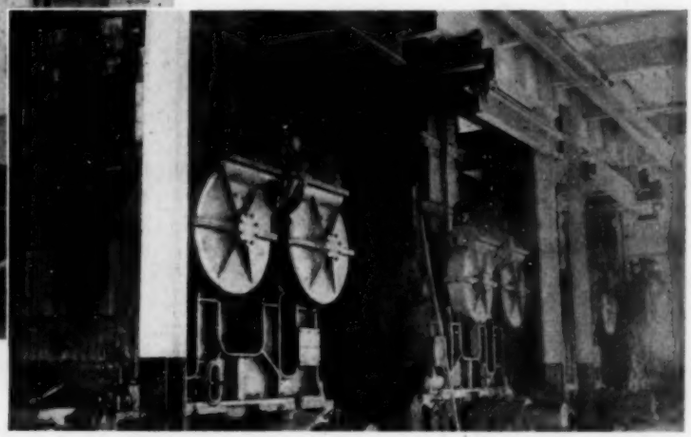


Fig. 1—Grinder charging floor showing bottoms of block bins and charging doors
Fig. 2 (Right)—Continuous type magazine grinders

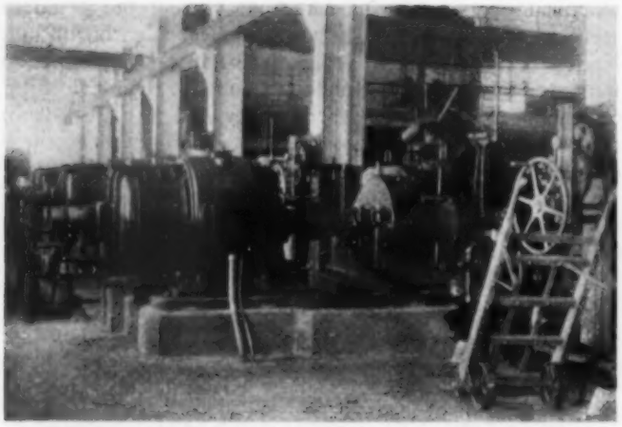


Fig. 3—Wet end driving motors

Two rotary sulphur burners, located on the same level as the digester charging floor and adjacent to it, burn 7 to 8 tons of sulphur per day (at present production of 240 tons of newsprint). Preheating hoppers straddle the burners using the heat of combustion to melt the feed sulphur. Steel combustion chambers are set behind the burners, in the usual manner, the sulphur dioxide being drawn through them down to the Jennsen gas coolers, consisting of heavy lead pipes in the form of vertical U-bends set in a shallow concrete tank, and cooled by water. The cooled gas is drawn down through fans, and blown into the two concrete acid towers at their bottoms. Acid is drained off at the base and run through a concrete settling tank, thence to the acid storage tanks outside the mill. A freight elevator runs between the sulphite towers for elevating buggies of sulphur and limestone.

AFTER a cook is complete, the digester is discharged under steam pressure to the blow pits. There are three "pits," which are actually wooden tanks, 30 ft. in diameter and 23 ft. deep covered and equipped with vents out of which the steam discharges through the roof. A perforated false bottom permits the sulphite liquor to drain to the sewer, after which the pulp is washed, by playing over it a heavy stream of water from a high pressure hose. In order to insure complete blending of different cooks, an "equalizing chest" is placed adjacent to the blow pits. This concrete tank measures 65½x12x15 ft. and is equipped with agitators to keep the pulp in suspension and well mixed. From this chest, the stock flows to three Bird screens in the mixing department, two of the three being fed direct and the third fed with tailings from the other two. Screened stock is thrown up to the 10-disk American filter, thickened to a consistency of about 5 per cent, the matted pulp being dropped to the sulphite stock chest which holds about 15 tons of 3 per cent suspension. The consistency of this pulp, as also of the groundwood pulp is automatically controlled by the ingenious Trimbey consistency regulator, which controls the water supply so as to keep the finished pulp thinned to the desired consistency. Automatic, also, is the mixing operation, whereby another Trimbey machine, the metering and proportioning apparatus, mixes the correct amounts of sulphite and groundwood pulps for supplying the paper machines.

Before the mixed pulp goes on the machines, it is screened again by a battery of three Bird screens at the wet end of each machine. These centrifugal screens discharge to the pond of the machines, where the stock is thinned by "white-water" and flows through an orifice, 234 inches wide, on to the fourdrinier wire. The particular design of orifice used is known as the Van de Carr slice, the invention of C. R. Van de Carr, manager of the Ste. Anne mill. Fig. 5 shows the wet end of one of the machines; the pond with the water spray pipes across it at the left; the 60-mesh wire screen running over the table rolls at speeds up to 1,400 ft. per minute; the deckle straps at the two edges of the wire which move with it and prevent the pulp from flowing off the edges of the wire before it drains and forms a sheet; the suction couch roll and the three sets of press rolls, the first two of which also apply suction to the sheet. At the right may be seen the drying rolls, covered by the hood from which the warm moist air is carried off.

SYNCHRONIZING the speeds of the drying rolls with the other sections of the paper machine is one of the most important details of paper machine design, since a slight variation in speeds produces tension on the sheet and breaks the paper. The Ste. Anne system of dryer drive is somewhat unique and apparently quite satisfactory. There are forty-six steam heated drying rolls, 60 inches in diameter, over which the paper is carried by broad felt belts. An endless rope runs through the rolls at one edge, by means of which the paper is threaded when starting, or after a break. In order that the upper and lower dryer felts may run at exactly the same speed, the rolls are geared together as shown in Fig. 4, two rolls being thus driven by one 18-hp. motor. These 23 motors draw their current from the same 550-volt line, so that the speed of all varies the same amount in case of line fluctuations. The dryer roll motor at the wet end is connected to the motors driving the wet-end rolls, and the last dryer roll motor is connected to those driving the calendars and reels at the dry end. This connection is made by means of the Harland interlocking sectional drive system, wherein a variation in the speed of the connected motors immediately causes a compensating movement of a rheostat regulating the field current and consequently the speed.

PASSING from the drying rolls, the paper goes through the calenders and is wound on the reels. A crane lifts reels over to the winders where the sheet is slit to desired sizes. The finished rolls are wrapped and weighed in the

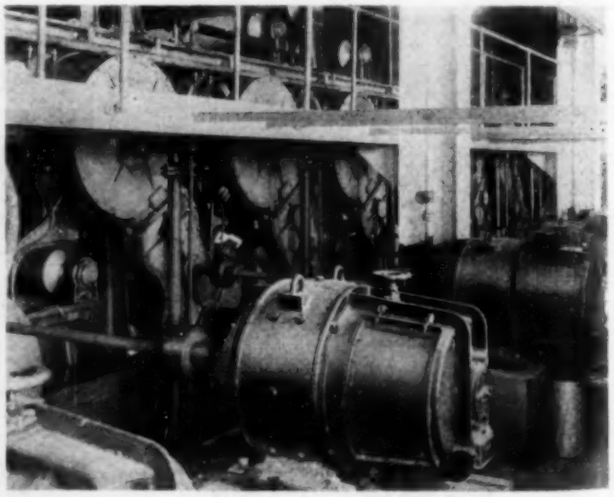


Fig. 4—Dryer roll drive showing gear connection between upper and lower rolls

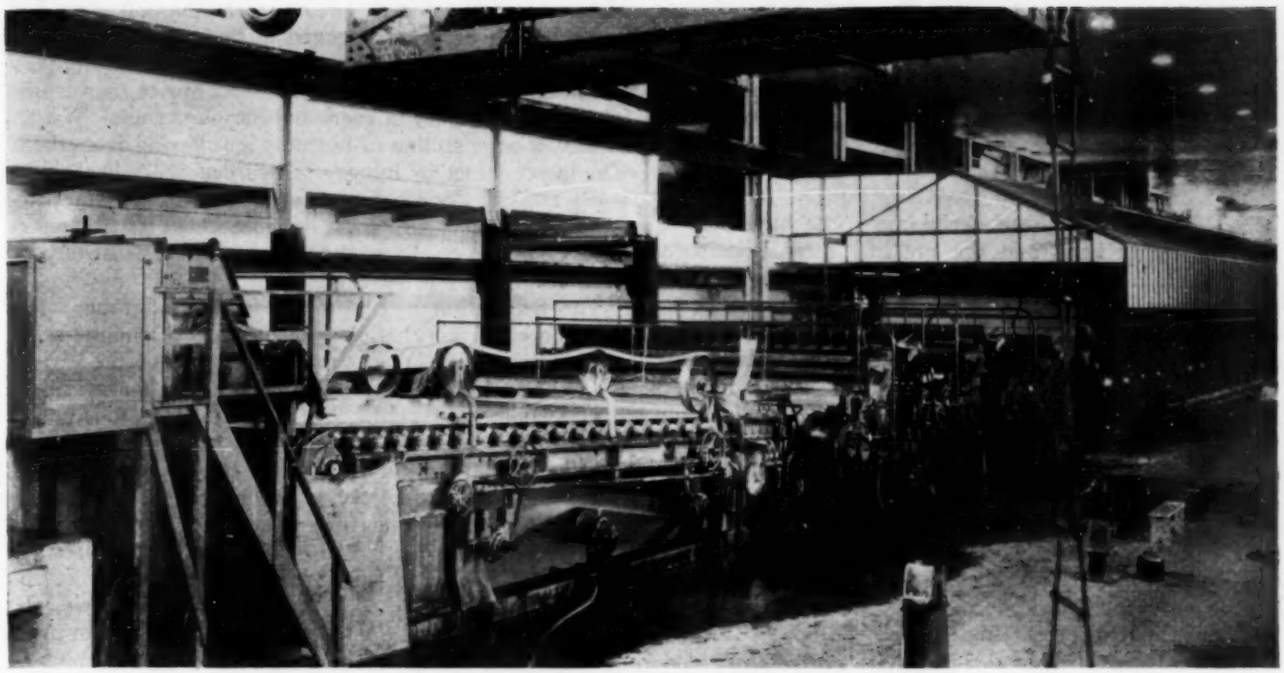


Fig. 5—Wet end of paper machine at Ste. Anne Paper Company, Ltd.

spacious finishing room which adjoins the machine room, and delivered by a de-elevator to the shipping platform below. Paper is being shipped by rail at present, although water shipment is entirely feasible.

At the time of the writer's visit, the integrating watt-meters showed the total power consumption of the plant to be 311,200 kw.-hr. per day. Power is purchased from the Duke-Price hydro-electric development at Ile Maligne, on Lake St. John, and delivered over a hundred miles to the mill substation at 66,000 volts. There it is stepped down to 2,200 v. for the grinder motors and 550 v. for all other applications through the mill. An electric boiler of 100,000 kw.-hr. per day capacity is used as an auxiliary source of process steam, since the purchased power is contracted for with a specified minimum consumption. The main steam plant consists of three 820-hp. Kidwell boilers, burning pulverized Nova Scotia coal and operating at about 250 per cent of rating. Coal is delivered from the cars by an automatically operated hoist to an elevated bin, weighted by automatic Richardson scales and delivered to the pulverizers, one for each boiler. The steam is expanded in two turbines, each of which drives a 650-kw. d.c. generator and a 900-kw. a.c. generator, the latter arranged to be operated as a synchronous motor if desired. These turbo-generators are operated so as to supply the amount of exhaust steam required by the driers, the current produced being used to drive the paper machines.

A well-equipped laboratory, in charge of a competent chemist, is one of the useful auxiliary departments of the mill. Among the determinations regularly made are hourly measurements of freeness of groundwood stock, consistency of accepted stock from Bird screens, moisture in paper, acidity of raw and cooking acid, SO_2 in gas to sulphite towers; strength test and basis weight determination for every reel; dirt sheet inspection of every sulphite cook; coal analyses and daily strength tests of groundwood and sulphite stocks.

For the pleasant privilege of inspecting this beautiful mill the writer is indebted to R. O. Sternberger, assistant manager and to R. C. Mode, chief chemist, who furnished some of the photographs here reproduced.

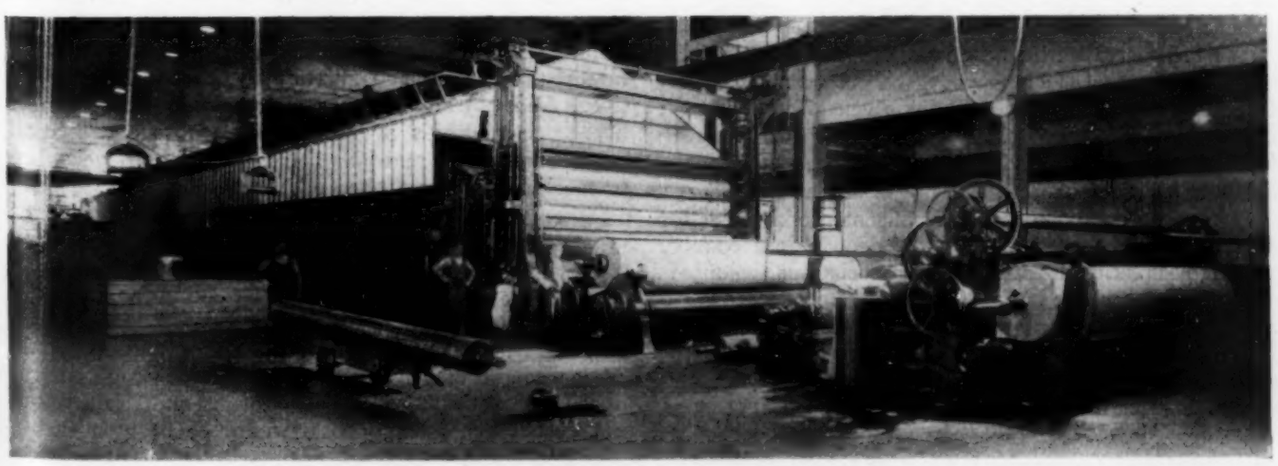


Fig. 6—Dry end of paper machine at Ste. Anne Paper Company, Ltd.

Teamwork for Profits in a Buyers' Market

By Edward J. Mehren

Vice-President, McGraw-Hill Publishing Co., Inc.

PROFITS have been shrinking. The buyers have the upper hand and are pressing their advantage. What, then, are the influences that lower and destroy profits? There is a long chain of them. It starts with over-capacity and includes, among other influences, the craze for volume, over-production, obsolete equipment and consequently high manufacturing costs, intense competition, a mobile and even fickle buying public, high selling costs, price profiteering by buyers and price cutting by sellers.

It is to be noted that not all of these difficulties are created by the dominance of the buyers' position, but their cure, nevertheless, would tend to insure profits despite the buyers' attitude. Further, the cure rests in large part with the individual manufacturer; this is the case, particularly, with the replacement of obsolete equipment and the selection of markets. Even in these cases joint action can create an industrial opinion which will be a spur to individual initiative and action. The other influences, obviously, will even more easily yield to industrial opinion, and that opinion can be created by teamwork.

Several of the chemical engineering industries, notably the fertilizer and heavy chemical groups, could have listened profitably to this sermon on business practice before the Manufactures Department of the U. S. Chamber of Commerce. "To supplant the craze for volume by a reasonable passion for profits" and "to eliminate buyers' profiteering and price cowardice" is sound advice for any industry.

Of all these profit-destroying influences I shall select but two because they need immediate correction. In fact, not merely action but revolutionary action is urgently needed. We need, first, to supplant the craze for volume by a reasonable passion for profits. And, second, we need to eliminate buyers' profiteering and the accompanying price cowardice.

At the very root of our difficulties lies the craze for volume. We'd sooner have volume than profits. A full factory and red ink seem as popular as 70 per cent operation and plenty of black. Crazy for volume! Swollen sales expense to get the last 20 per cent of business. Ruinous prices to fill up the factory. The goal is volume, not profits.

We fail to realize that the law of diminishing returns cannot be flouted. The nearer we get to perfect performance the smaller the gain for given effort. It can't be escaped. The top business costs more than it is worth and only injects an undesirable color scheme into our balance sheets.

Here is an opportunity for beneficent propaganda, for spreading a fire of sound business doctrine the country over; for creating through trade associations, chambers of commerce and the business press a country-wide sentiment for restoration of fair profits as our business goal. Let business men be business men—this be our slogan; and no one is a business man who, in the craze for volume, takes less than a savings bank return on his capital, who swaps dollar for dollar, or worse than all, pays for the privilege of being engaged in business at all.

The second revolution that is needed relates to buyers' profiteering and its accompaniment, price cowardice. They are not found in every industry nor trade. Nevertheless, a large section of business is suffering from them. The buyer, beset by hungry sellers, has the seller on the run. He plays one seller against another until the price is down not merely to rock, but in a hole blasted deep *in* the rock by the combined dynamite and T.N.T. of buyers' profiteering and price cowardice.

The temptation in this matter is to find fault solely with the buyer and his profiteering tactics, but the seller is often to blame. The purchasing agent doesn't have to ask for price concessions. If he will ignore quoted prices for a couple of days the sellers will besiege him not to argue the merits of their wares, not to produce the conviction that is a salesman's pride, but to cut the price. Why shouldn't the buyer take advantage of such a situation? Why shouldn't he let the sellers fight it out for him?

The reform, then, rests in part on the seller. If the buyer is as he is, we, the sellers, have helped to make him so. We are reaping as we have sown. But we cannot entirely absolve the buyer. Price inquiry by buyers is natural and proper, salutary to buyer and seller alike. But price clubbing, using one bid and then the other, and back again two or three times, is guerilla warfare, with the buyer safely in the tree tops, sardonically egging on the combatants to self destruction. What are we going to do about it?

Here are two suggestions for the remedy: *First.* Let all sellers determine not to cut a price or bid once it has been submitted. Let's do all our figuring in advance. Then stick by our price. In other words, let's adopt the system of firm bids and prices. *Second.* Let all sellers insist on seeing all submitted prices when price concessions are demanded. The purchaser who is "on the square" will show them. Business shouldn't be stud poker with all the cards turned down.

IN INDUSTRY'S hands lie the stopping of abuses and the creating of sound business practice. The two factors that have reduced profits in this buyers' market can be eliminated if industry will (1) create industrial opinion against the craze for volume and in favor of the restoration of profits to their rightful place as a business objective. And (2) create industrial opinion for a system of firm prices and bids, and for a general insistence that all competitive prices and bids be shown by the buyer when price concessions are asked.

These proposals do not run counter to either economic or statute law. Competition would not be done away with. There would be neither collusion nor compulsion. The process would be educational. The object would be the creation of industrial opinion.

The results would be that volume ambitions would again become reasonable, over-production would be reduced, competition would be vigorous and healthy, but not destructive; selling costs would be brought within sane limits, and price profiteering and price cutting would be minimized. Profits would promptly respond.

Extracts from an address before the Department of Manufacture, Chamber of Commerce of the U. S. A., at Washington, May 9, 1928.

Designing Equipment for Chemical Treatment of Oil Distillates

By J. C. Morrell and D. J. Bergman

Universal Oil Products Company, Riverside, Ill.

EDITOR'S NOTE: *The chemical operations in the refining of gasoline and related petroleum distillates depend primarily upon efficient mixing and agitation and the proper separation of the products of reaction. In the April issue of Chem. & Met. Drs. Morrell and Bergman discussed the principles underlying the design of orifice and other column mixers, pumps, blow-cases and mechanical mixers. The present paper continues the discussion of the individual elements and their arrangement and assembly in the finished treating plant.*

BLOW-CASES are still commonly used in petroleum refineries for measuring and handling the sulphuric-acid and caustic-soda solutions used in the chemical treatment of oil distillates. In order to proportion the reagents when blow-cases are used under various differential pressures, several sizes of orifices must be used. To facilitate the design of these orifices, the writers have made the following calculations:

Flow of Acid and Caustic Through Orifice

Specific Gravity of 66-deg. Bé. Acid 1.84
Specific Gravity of 30-deg. Bé. Caustic Soda 1.26
From general orifice formula:

$Q = CA\sqrt{2GH}$

Q = Quantity in cubic feet per second
C = Coefficient—approximately .61 for low ratio of diameter
A = Area of orifice—square feet
G = Gravity constant—32.2 feet per sec. per sec.
H = Pressure drop across orifice—feet of liquid

Transferring pressures in pounds to head of liquid of the desired specific gravity, we have

$$\text{Acid—1 lb. per sq.in.} = \frac{2.30}{1.84} = 1.25 \text{ ft. of acid}$$

$$\text{Caustic—1 lb. per sq.in.} = \frac{2.30}{1.26} = 1.825 \text{ ft. of caustic}$$

Diameter of Orifice Inches	Area Sq.In.	Pressure—Lb. per Sq.In. Q = Pounds of Acid per Hour 4	20	Q = Gal. Caustic per Minute 4	20
1-16	.0031	97	217		
3-32	.0069	216	483		
1-8	.0123	385	860	.51	1.13
5-32	.0192	600	1,344	.79	1.77
3-16	.0276	864	1,930	1.14	2.54
1-4	.0491	1,540	3,440	2.02	4.54
5-16	.0765	2,400	5,350	3.15	7.05
3-8	.110	3,440	7,680	4.53	10.15
7-16	.150	4,690	10,500	6.18	13.85

As examples of the use of these charts, the following are given:

Example No. 1:

To use 3 lb. of acid per barrel and 1 per cent caustic solution for treatment of 100 bbl. of distillate per hour through a mixing coil, the weight of acid required per hour is 300 lb.

From the sheet it is seen that a $\frac{3}{32}$-in. diameter orifice will pass 300 lb. of acid per hour with a differential pressure of 8 lb. In this case the pressure on the acid blow-case would be set by changing the air reducing valve to give an 8-lb. differential from the blow-case to the inlet of the acid-mixing coil.

A 1 per cent treatment of caustic represents 0.7 gal. per min., and will pass through a $\frac{1}{8}$-in. diameter orifice with a 7.5-lb. pressure-differential.

Example No. 2:

Assume that the acid is to be supplied by means of a blow-case through an orifice. For 4 lb. of acid per bbl. of distillate, there would be 1,200 lb. of acid required per hour. Two blow-cases each holding 10 bbl. would suffice for an 8-hr. run.

Referring to Fig. 8, a $\frac{3}{16}$-in. orifice with a pressure differential of 7.6 lb. will be seen to discharge 1,200 lb. of acid per hour; or a $\frac{5}{32}$-in. orifice may be used with a 16 lb. differential.

Air is supplied to each pair of the blow-cases through a $\frac{3}{4}$-in. pressure-reducing valve which can be easily set at any desired pressure. The proportion of acid to oil can be changed by changing the pressure on the blow-case, or by substituting an orifice of different size.

The proper size of orifice for the plumbite treatment is found similarly. Assume that the plumbite treatment is to be 1 per cent of the distillate or 2.1 gal. per min. Referring to Fig. 9, a $\frac{3}{16}$ in. orifice will pass 2.1 g.p.m. of 30 deg. Bé. caustic with a 14-lb. differential.

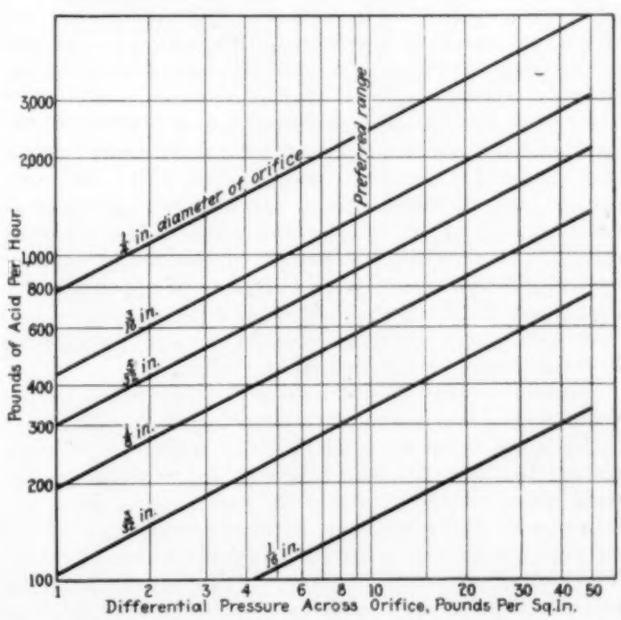


Fig. 8—Flow of 66-deg. Bé Sulphuric Acid Through Various Orifices

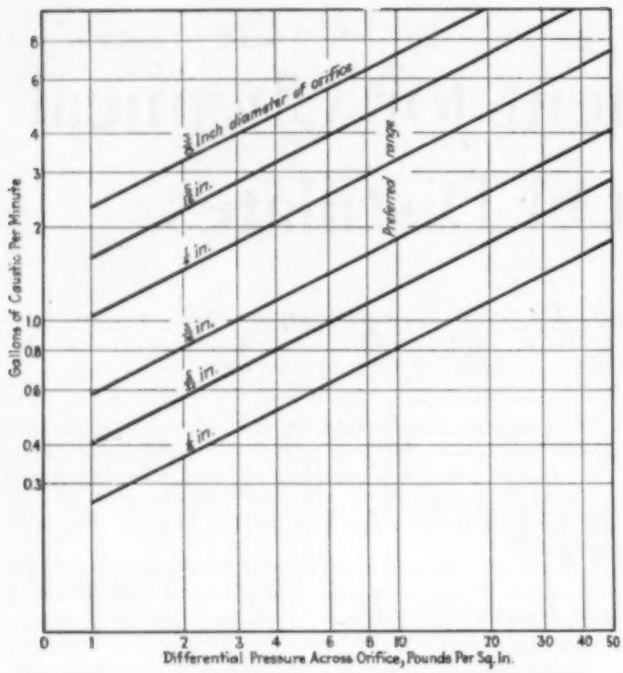


Fig. 9—Flow of 30 deg. Bé Caustic Soda Solution Through Various Orifices

Even if the acid or caustic is not of the strength indicated on Figs. 8 and 9, the error made in using the charts is so small that it can ordinarily be neglected.

It is recommended that the differential pressure across the orifice be kept between the limits of 6 and 20 lb. for good results. Too low a pressure can cause large variations in the quantity flowing due to comparatively small fluctuation in the pressure. Too large difference of pressure results in a small orifice, which is easily plugged or corroded to give a greater quantity than is desired.

Blow-cases may be designed in accordance with A.S.M.E. specifications for non-fired pressure vessels. A safety factor of 8 is recommended instead of 5 on account of corrosion, or a rough rule to be guided by is to allow $\frac{1}{8}$ in. for corrosion. The capacity of the blow-cases should be sufficient to take care of a one-day or one-shift operation and the blow-cases should be installed in duplicate.

Reagent Pumps—The acid-feed pump is to be of the positive piston, duplex or rotary type and a similar pump is to be used for the caustic and plumbite feed. The acid, caustic, and plumbite pumps are to have an approximate capacity of 10 bbl. per hour with by-pass arrangement. The recirculating pumps of the rotary gear or centrifugal types are to have a capacity of approximately 20 bbl. per hour, also with by-pass arrangement.

Acid-resistant bronze or cast iron and steel pumps with liners will serve for both acid and alkali.

Settling Tanks—It has been previously stated by the writers that the chemical treatment of oil distillates depends upon the two fundamental principles of efficient contact between the oil and the chemical reagent and the withdrawal of the products of the reaction from the treated oil. The question of efficient contact between the oil and chemical reagent has been discussed in detail. The withdrawal of the products of the reaction from the treated oil is accomplished by discharging the mixture of oil together with the sludge resulting from the reaction between the oil and the reagent, as well as unused reagent, into settling tanks or chambers and allowing the sludges and unused reagents to settle out. Automatic liquid level controls may be used on the settling tanks although this refinement has not been found necessary.

For each reagent in the chemical treatment of the oil, i.e., for each individual step in the treatment, a mixing element and a settling element are required. Usually, water-washes are carried out in the settling tank itself, hence, additional settling tanks will be required depending upon the number of water-washes used in the treatment. A water-wash follows the application of each reagent after the products of reaction have been removed.

Settling tanks in a continuous treating system should be large enough to give the required time element to settle out the sludge and excess of reagent used. Approximately one hour has been found to be ample settling time for most distillates and reagents. In the case of high capacities, it is sometimes well to use two tanks in series. Normally, the inlet to a tank should be made at the point where the separating level is kept. If the inlet is made tangential to the tank a whirling motion is set up which will assist the action of gravity in settling and at the same time will not tend to cause as much turbulence in the tank as an inlet straight into the side.

The water-spray for washing can be made of pipe in the shape of a cross, either welded or connected by fittings. Two such crosses, one above the other to cover the area of the tank, are used. The perforations are arranged in one or two sets at the bottoms of each pipe. When the spray holes are made on one side of each pipe only, the flow of water through the holes will tend to assist the rotary motion set up by the tangential inlet to the tank, thus assisting washing. Usually $\frac{1}{8}$ in. or $\frac{3}{32}$ in. holes are satisfactory in the spray unless the water is very hard. Even in this case counter-sinking the holes from the outside will help to prevent plugging. The spray should be set 5 ft. to 10 ft. below the overflow of the tank (one-fourth to one-third the distance from the top) so as to have a clear space to settle out as much water as possible before going to the next tank.

An orifice mixer for water-washing is not recommended unless it is followed by a tank wash, because while the parallel flow of water and distillate gives a very efficient mixing, a large quantity of water is required to reduce the amount of reagent in the oil. Further, the formation of emulsions sometimes results with this type of mixing and it is difficult to obtain separation of the oil. Usually better results can be obtained by washing in the tank.

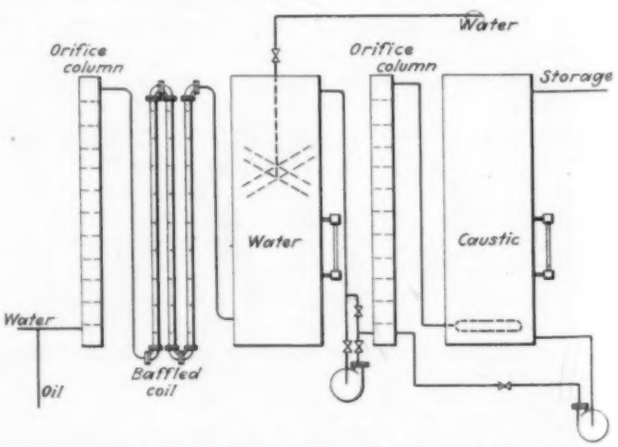


Fig. 10—Caustic Washing System for Pressure Distillate and Gasoline

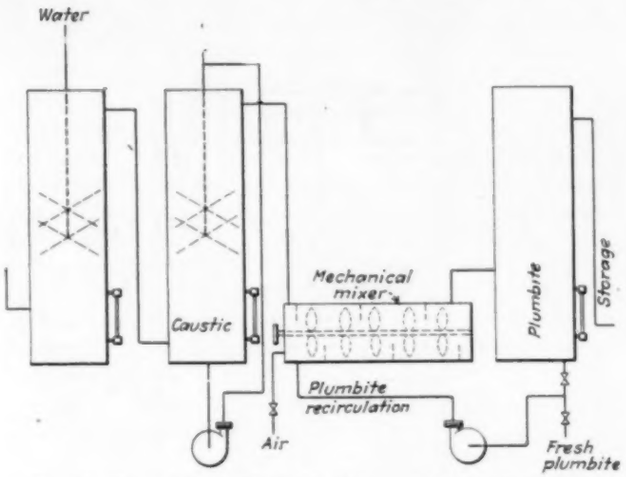


Fig. 11—Pressure Distillate Washing and Sweetening System

Arranging and Assembling the Treating Plant

ARRANGEMENT of the treating plant depends upon the particular order of treatment, which in turn is dependent upon the type of distillate to be treated. As equipment for cracked distillates may be used also for the chemical treatment of distillates of less complex composition the design of treating plants, especially of continuous treating plants, will be directed toward the methods used for cracked distillates. The following methods have been published [*Ind. Eng. Chem.*, vol. 18, page 733 (1926)] by one of the authors and are given for reference:

Method 1—This method is applicable to cracked distillates that can be treated with the least difficulty.

(a) Agitate with sulphuric acid (usually 66 deg. Be.). Settle and draw off the sludge.
(b) Wash well with water.
(c) Treat with solution of sodium hydroxide, followed by short water-wash.
(d) Distill in the presence of steam, preferably introducing the steam into the oil. The steam distillation may be assisted by a low fire. It is preferable to use a continuous or semi-continuous method in distilling. The two methods avoid long-continued heating of the cracked distillate.

Method 2—This is the most desirable and most generally applied method for the treatment of cracked distillates. It is practically the same as Method 1, except that a plumbite treatment (litharge dissolved in a solution of sodium hydroxide) replaces the treatment with a solution of sodium hydroxide.

(a) Agitate with sulphuric acid. Settle and draw off the sludge.
(b) Short water wash, usually 5 to 10 minutes.
(c) Agitate with plumbite solution. The product should show a negative doctor test at this stage. If a suspension is formed on addition of the plumbite solution or after blowing or agitating, allow it to settle and draw it off. Under any circumstances draw off the plumbite solution after settling. Do not use sulphur.
NOTE.—While it is desirabie to have the treated cracked distillate sweet before distillation, the sweetening treatment shown below may in some cases be completed during distillation. On the other hand, too high a temperature (local or otherwise) of redistillation will produce sourness in practically all cracked distillates, owing to the formation of hydrogen sulphide and mercaptans.
(d) Wash for a short period with water, agitating if suspended material is removed, but simply showering if still present, to avoid emulsion. This water-wash may be dispensed with in most cases.
(e) Distill in the presence of steam, following the precautions shown in Method 1, preferably using a continuous method of distillation.
(f) If the gasoline distillate is sour, sweeten by treatment with plain solution of sodium hydroxide, using the most dilute solution which will accomplish the purpose. A final water-wash is desirable here. The final caustic-wash removes hydrogen sulphide formed during the distillation.

It is sometimes desirable that a water wash precede the acid treatment to remove undesirable water-soluble compounds such as hydrogen sulphide. A caustic wash followed by a water wash serves the same purpose better.

Method 3—This method is especially applicable to cracked distillates from light or heavy Californian, Mexican, South American, and similar oils, and gives a sweet, stable product seldom obtainable by the methods previously described with cracked distillates from these oils. A better reduction in sulphur content has also been noted in some cases. One of the authors has used this method with success for several years, and refers to it as the "split plumbite" method since a treatment with plumbite both precedes and follows the acid treatment.

(a) Apply preliminary water wash. Treat with plumbite solution, preferably stronger than 20 deg. Bé. Settle and draw the sludge.
(b) Short water-wash, simply showering if suspension is present. Draw off as much water as possible before proceeding to the next step.
(c) Agitate with a small quantity of sulphuric acid (about 1 lb. per bbl. of distillate) and draw the sludge after settling.
(d) Apply the main sulphuric acid treatment. Draw the sludge.
(e) Short water-wash.
(f) Agitate with plumbite solution (about 10 deg. to 16 deg. Bé.). Remove the used plumbite. (If a "doctor-sweet" product is not required, a plain sodium-hydroxide solution may be substituted here for the plumbite solution with good results for some oils.)
(g) Water-wash. (This step may be omitted in many cases.)
(h) Distill in the presence of steam, following previously mentioned precautions.
(i) If the gasoline comes over sour (positive to the doctor test), treat with the most dilute solution of sodium hydroxide which will sweeten it. If dilute caustic will not sweeten the gasoline distillate, a dilute plumbite solution will serve this purpose without the use of sulphur. A final water-wash is desirable here. The treatment with caustic is desirable under any conditions to remove hydrogen sulphide as well as sulphur dioxide.

Method 3 is practically the same as Method 2 after step (d). No sulphur is used in the above treatment at any stage.

For batch-treatment or semicontinuous treatment with batch-agitators, the same type of equipment may be used for the several methods shown. Methods 1 and 2 will require the same type of continuous treating-system and both of these methods are applicable to the treatment of straight-run distillates. In most cases where straight-run distillates are treated, the distillation step is omitted, and usually the plumbite treatment is followed by the addition of a small amount of sulphur to convert the lead mercaptide to the disulphide.

SINCE removal of hydrogen sulphide is a preliminary step in the treatment of cracked distillates containing much of this component, the design of equipment for this purpose will be discussed first.

Fig. 10 shows a system for the treatment of distillates for removing hydrogen sulphide. Three different water-washing devices are attached to the first settling element of this system and any or all of them may be used depending upon the type of distillate and conditions. Distillates containing small quantities of hydrogen sulphide may be discharged direct into the settling chamber and sprayed with water by the perforated pipes shown. For larger quantities of hydrogen sulphide where the oil shows only a slight tendency to emulsify and separation is not difficult, the orifice column and the baffled coil may be used in conjunction with the water spray. Where the oil shows a marked tendency to emulsify, the orifice

column may be eliminated, and for oils that emulsify badly, only the water spray is used, even if the oils contain high percentages of hydrogen sulphide.

The oil overflows and is discharged under the primary pump pressure through the orifice column into the caustic tank, where a bulk supply of caustic is maintained. This caustic is recirculated through the orifice column with the oil, thus removing the last traces of hydrogen sulphide. For high capacity, the pick-up pump shown between the water settling chamber and the orifice column is used to relieve the back pressure upon the treating elements preceding it. The design of the elements which made up the equipment has already been discussed in a previous portion of this paper.

The same equipment can serve for pre-treatment of cracked distillates with plumbite solution. A more complete plant for this purpose is shown in Fig. 11, in which a mechanical mixer is used for agitating the plumbite solution with the oil. Provision is made for introducing fresh plumbite solution and for introducing air into the system to oxidize the lead sulphide or, in part, the mercaptides, so as to maintain the strength of the plumbite by re-solution of the oxidation products, viz., the lead sulphate and the lead oxide respectively.

A simpler arrangement for the removal of hydrogen sulphide from distillates consists of a jet eductor which may be installed between the separator tank of a cracking unit or the run-down tank of a distillation unit and the run-down tank. The suction side of the jet eductor is connected to the water spray or caustic supply depending upon the characteristics of the distillate.

Batch-Treating Systems—It has been the practice for years in the oil refining industry to use batch-treating systems consisting of vertical, cylindrical tanks with conical bottoms. In most cases these agitators are lead-lined and equipped with charging lines for oil and reagents, spray pipes for water-washing, air line for air agitation, and branched draw-off lines for removal of the oil and sludge. Air agitation causes very great losses owing to evaporation, and this loss is the chief drawback to the use of the old type of agitator. By the substitution of mechanical agitation in whole or in large part for air agitation, the objection to the use of the batch agitator disappears and with such modified agitators there are some advantages, such as carrying out more complicated treatments than those which could be taken care of simply by continuous treating systems. The conversion of the batch agitator is especially desirable where such equipment is already on hand. Fig. 12 shows a fully equipped batch agitator which has been designed to utilize all the advantages of an agitator.

A special feature of this modified batch-agitator in addition to the circulating pump is the arrangement for the separate draw-off in regulated proportions of oil and sludge to be recirculated. This provision permits mixing the reagent with the oil in any proportion in the pump.

As an example, the design of a 1,000-bbl. agitator will be discussed.

A rotary pump, preferably of the centrifugal type, is to be installed as shown, connected with recirculating lines for drawing off separately the chemical reagents (such as the acid or acid sludge, plumbite or caustic) and the pressure distillate. The relative proportions of the reagent and the pressure distillate are controlled by the valves shown. The reagent and the pressure-distillate enter the suction side of the pump and are discharged

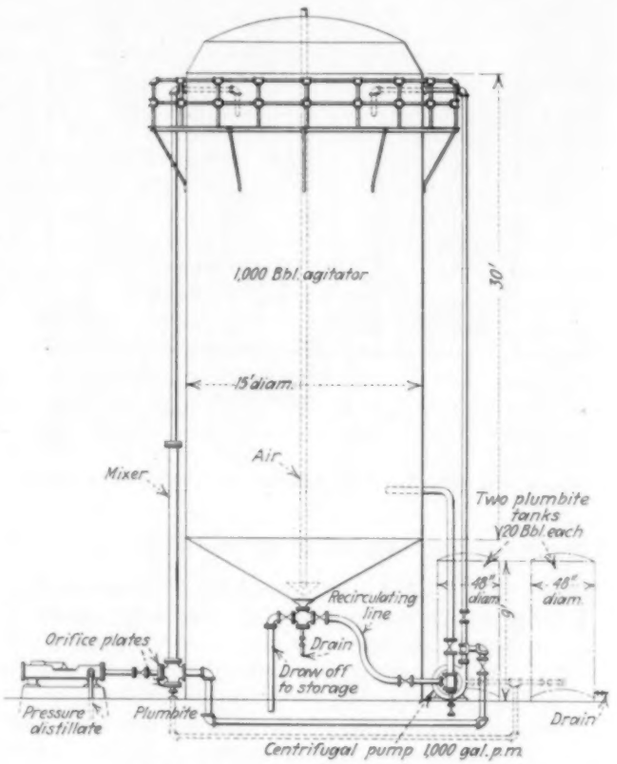


Fig. 12—A 1,000-Bbl. Agitator for Batch Treatment of Pressure Distillate

Aside from the equipment shown in this diagram, the following tanks will be needed: 1 acid storage tank, 1 acid blow-case, 1 caustic mixing or solution tank, 1 plumbite mixing or solution tank and 1 waste plumbite storage and recovery tank.

through the line leading into the top of the agitator. The discharge end of this line should be below the level of the oil in the agitator.

For a 1,000-bbl. agitator the centrifugal pump should have a capacity of at least 1,000 g.p.m. so that the contents of the tank may be circulated and mixed within a reasonable time of treatment. With 1,000-g.p.m. pump the contents of the tank will be circulated through the pump in less than an hour, allowing for a large proportion of reagent passing through the pump—e.g., from 15 to 20 per cent.

The impellers of the centrifugal pump will also serve to mix the reagents and the oil as they pass through the pump. The pressure distillate draw-off line is located above the level of the reagent to permit the separate withdrawal of the oil.

The capacity of the pump should be based upon a 50 lb. head, which will take care of circulating through the orifice column and also will enable the pump to be utilized as a transfer pump from storage to the agitator and back. This will ordinarily mean a pump with about a 4-in. discharge, run by a motor or steam turbine. The pump may be entirely of cast-iron or it may be of cast-iron fitted with acid-resistant bronze to eliminate corrosion of working parts by the solutions which pass through it. A vacuum and pressure gage, reading up to 15 lb. per square inch, should be installed on the suction line of the pump where the solution lines enter from the various blow-cases.

For measuring liquids, an orifice and manometer may be used and where used should be installed in the discharge of the pump. The orifice for the flow of the larger quantities of liquid may be made up of a plate drilled with a 2-in. hole installed between two flanges in

the 4-in. line. The mercury manometer is tapped to the line 10-in. in front of the orifice and about 3 ft. beyond it.

A flow of 200 gal. per minute through this apparatus will show a deflection of approximately 10-in. on the manometer, which should have a total height of 18 in. of mercury. This flow measuring equipment should be placed upon a by-pass. Separate lines are to be brought to the pump for suction and discharge of treated and untreated pressure distillate and gasoline. This prevents contamination of a treated product, especially gasoline. The air line may be left in place for auxiliary agitation if necessary, although air agitation is to be cut down to a minimum with the circulating system in operation, excepting in cold weather.

Another feature of the present arrangement is an orifice-column mixer connected to the discharge of the centrifugal pump on one side, and to the pressure-distillate charging-pump on the other side. This arrangement permits making the preliminary treatment with plumbite or caustic while charging the oil into the agitator, and also permits recirculation through the orifice mixer to obtain more efficient mixing with the acid or other reagent.

Assuming a charging capacity of 300 bbl. per hour and a friction head per plate of 10 ft. or 3.2 lb. per plate, and allowing a back pressure (pressure drop) of 30 lb., exclusive of the liquid head, the orifice area upon each plate would be 4.1 in. This is equivalent to two $1\frac{1}{4}$ in. openings in each plate, allowing $\frac{1}{16}$ in. uniform clearance for the plate in an 8-in. pipe. The orifice column is to be made of 8-in. standard pipe. The use of 10 plates would give a 30 lb. back pressure (pressure drop) due to the liquid passing through the openings.

The plumbite or caustic fed with the oil is regulated by a positive-stroke pump or a rotary pump with proper by-pass for control of the amount being fed into the system.

The agitator shown in Fig. 12 is 15 ft. in diameter by about 30 ft. high and has a full steel roof. It should preferably be lead-lined to prevent the action of acid on the steel when washing the pressure distillate after an acid treatment. This lining may be either sheet lead about $\frac{1}{8}$ in. thick, or may be lead that is sprayed on by one of the metal-coating processes. At the bottom of the cone is a main valve leading into a header from which lines go to sump, sewer, and centrifugal pump suction; there is also a sample line. At the top of the agitator, above the liquid level, should be installed a water-spray system. Four or six spray nozzles similar to those used commonly on spray-ponds for cooling water are satisfactory. These should be installed high enough above the oil level to give a uniform fine spray on the surface, thus insuring efficient washing. The discharge from the centrifugal pump may be split at the top by two valves. One line should be continued down on the inside of the agitator to the top of the cone bottom. This line is to be used when charging. The other line should be installed so as to give a tangential flow near the top of the agitator under the liquid level and assist in stirring or agitating the pressure distillate with the reagents. The agitator is equipped with stairs, runway, explosion doors, and other auxiliaries which are generally used.

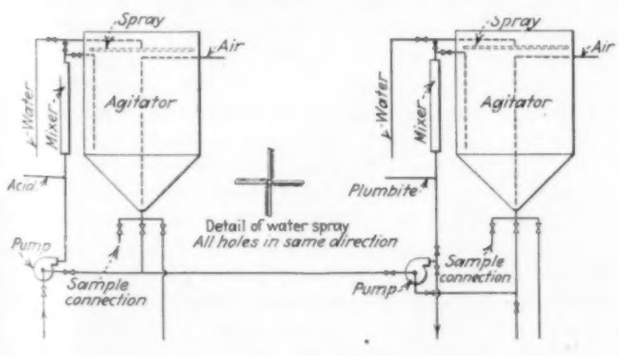


Fig. 13—Flow Sheet of Semi-Continuous Treater Using Two Batch Agitators

CONSTRUCTION of the orifice column and general method of design have already been discussed in previous portions of this paper. "The column described was designed specifically to mix the pressure distillate with plumbite or caustic while charging and the pump is to take care of acid mixing. To use the column as shown for mixing by recirculation would slow down the treating time to approximately 300 bbl. per hour assuming a 30-lb. head on the pump. This would be undesirable. For additional mixing by recirculation, two 6 ft. lengths of 8 in. pipe in parallel may be used. They may be positioned vertically or horizontally; as an example, each one of these is to be equipped with five plates, each plate to have a total orifice area of 7 sq.in. The best way to dispose of this is to have seven $1\frac{1}{8}$-in. holes drilled in each plate.

"This would be equivalent to a back pressure of 3 lb. per plate at a capacity of 500 bbl. per hour through each pipe, or a total of 15 lb. for each pipe when placed in parallel at a capacity of 1,000 bbl. per hour. The two pipes containing the orifice plates are to be located on the discharge side of the centrifugal pump, with proper valve arrangement."

Where such systems are already installed, two batch agitators may be connected in series to form a semi-continuous treating system. In the flow sheet, Fig. 13, two agitator shells are shown for the purpose of making a more complicated treatment than can be easily handled with a continuous process.

By this system the distillate can be pumped through an acid mixer into an agitator and allowed to settle. Then the secondary treat can be made in the same agitator by circulating the distillate through the mixer, using the proper chemicals. If desired, air-blowing can also be used, although this is not recommended for light distillates. By picking up the distillate from the bottom and forcing it through the water-spray pipes in the top, a gentle circulating motion will be set up in the agitator and the fine streams of distillate and chemicals will give good contact and the desired reaction.

When the desired treat is finished in the first agitator, the distillate can be picked up by the second pump and pumped through the mixer into the second agitator in which additional treating may be done, to follow variation from the ordinary simple treat. By this method split acid and split plumbite treatments are made very simple.

In a subsequent and concluding portion of this article there will appear a similar discussion of the design of continuous treating systems illustrated by diagrams of the detailed arrangement of two systems. Additional data on the construction of the mixing columns and settling columns will also be given and the article will then be concluded with a practical discussion of the procedure involved in the actual operation of a continuous plant for treating pressure distillate.

Chemical Engineering in the MEAT PACKING *Industry*

By C. Robert Moulton
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SCIENTIFIC developments in the meat packing industry which have occurred in recent years are not, by any means, the result of the efforts of single individuals, of single companies, or, in fact, of the industry itself acting alone. Chemistry and engineering, of course, have been used singly and together in attacking most of the problems. There are many problems, too, where other sciences have been called upon for aid. One of the chief of these is bacteriology, since a major difficulty thus far in the meat packing industry involves spoilage due to bacteria and molds.

The inter-dependence of individuals, organizations, and industries necessary in solving such problems as are here discussed must be clearly comprehended. An individual in an organization, even if that organization be the official spokesman for the industry, can make such a discussion worth while only by presenting the experience and points of view of others in addition to his own. The Institute of American Meat Packers has within its organization ten departments, of which a number have contributed to this article; but special mention should be made of the assistance given by the Department of Scientific Research and the Department of Packinghouse Practice and Research.

Viewing the operations, then, which are marked by this co-ordinated advance in technology, one may begin with the process of rendering—that is, the separation of fatty matter from the retaining tissues. The time-honored method of rendering most of the fats and greases from their tissues involves cooking the materials in water in closed tanks, in which a considerable steam pressure is employed. The lard, tallow or grease drawn off must be settled, decolorized by fuller's earth, filtered, and finished on the lard roll and in the picker box. The solid material is pressed and yields tankage, while the watery liquid must be concentrated to form a product known as stick. This stick is reincorporated with the dried residues to yield the finished tankage.

A NEW process known as the dry rendering process (see *Chem. & Met.*, July 16, 1923, pages 93-96) uses a horizontal steam-jacketed vessel with rotating arms to agitate the material while it is being cooked. The hashed or crushed raw material is put into the vessel without any water. The moisture contained in the tissue is evaporated, leaving dry residues which are cooked in the fat. When the process has been completed the material is discharged into a tank with a perforated false bottom. The lard drains off and the cracklings are pressed either through an expeller or a curb press. The resulting cracklings are used for chicken feed and similar purposes. The lard is treated somewhat similarly to the wet rendered lard. In this process no stick is formed and animal feeds are produced in place of tankage for fertilizer. Again, tanks and presses now in use are largely discarded and replaced by rotary melters and expellers. The process may be run by the batch method or continuously. It affects raw supplies for glue stock, however, since fat skins, bones, and sinews when so treated are no longer fit for manufacture into glue.

While this process has been used chiefly for inedible tallows and greases it is also being used for the manufacture of lard. Lard so made has a different flavor than the steam rendered product and is somewhat harder to decolorized. The process is becoming quite popular and is one of the chief means of reducing packing house odors to a minimum.

ONE HAS known for some time that fats and oils containing unsaturated fatty acids are improved and hardened by adding hydrogen to the fatty acids. The catalyst usually employed is finely divided nickel. The meat packing industry has had a prominent place in the development and application of this process. Application so far has been to vegetable and nut oils as well as to fish oils. Fats from the domestic food producing animals have not been so treated, nor do they need it. By means of this process oils not qualified for use as shortening agents are made competitors for lard, the packer's standard product.

The competition just referred to has made it desirable for the packer to become better acquainted with the qualities of his fats and to devise methods of testing the stability of these products as affected by air, impurities, time, and temperature. Laboratory methods of measuring keeping qualities are being devised and tested. While for centuries lard has been a standard medium in kitchen and bakery for shortening and cooking purposes, more scientific study of methods of manufacture and storage may result in more uniformly satisfactory products.

According to the customary method of procedure, the watery liquors containing gelatin, which are obtained in the first steps of the manufacture of this product, are evaporated and chilled until they congeal to a firm jelly, and are then further dried to a low moisture content in a drying alley, through which warm air is passed rapidly. This air must be thoroughly purified first, so that no dust and bacteria can get into the gelatin. The temperature and humidity must be controlled, otherwise the gelatin may melt and run through the wire meshes of the frames on which the drying is done.

By a recent improvement in this process the gelatin liquors are concentrated and then fed onto a large, heated, revolving metal drum. The rate of heating, the speed of the drum, and the amount of liquor fed onto the drum are so controlled that before a complete revolution is made the gelatin has been dried to a low water content. It is scraped off the drum by a knife. The

gelatin cakes or flakes may then be crushed, ground, flaked or otherwise changed in size. The product of this process is a gelatin of very high quality.

A big problem of the meat packing industry has always been the prevention of spoilage of readily perishable products, such as meats not properly chilled and stored. Being good foods for man it would seem that they are also good foods for bacteria and molds. Machinery, benches, and tools having particles of meat on them lend themselves excellently for the growth of bacteria and molds. Ordinary cleanliness helps to prevent this; and after the apparatus or bench is cleaned it may be steamed well and then dried. Bacteria are killed in this way and no food or moisture is left to support new colonies of bacteria which may find their way to the apparatus.

The World War has given the packing industry a new weapon to use against these enemies. Sodium hypochlorite—the Dakin's solution of war fame—readily kills micro-organisms with which it comes in contact. Dilute solutions of this product may be sprayed over cleaned apparatus, benches, tools, and even the ceilings, walls and floors of rooms which are harboring molds and bacteria. All meat and fat residues must first be removed. Meats in these rooms may simply be covered by clean tarpaulins and the spray then used. Molds and bacteria are readily killed by the oxygen or chlorine freed from this compound. Common salt is the end product. In fact the sodium hypochlorite can be readily made from dilute salt solutions by electrolysis.

IN MOST packing houses a good part of the pig is cured, smoked and held for later use; hams bacon and shoulders receive this treatment. The ham is a fairly large piece of meat. In order to cure it properly and to obtain a fine-flavored finished product of good keeping qualities certain fundamental conditions must be observed. These conditions have to do with prompt and efficient chilling, rapid cutting and trimming of the hams, so as to deliver the meat to the pickle cellars while still cold, and proper curing and smoking.

Sometimes hams spoil during the curing process. The science of bacteriology has taught the packer that bacteria cause this spoilage. How and where the bacteria enter are questions the meat curer has asked of his technical men. To answer the question a careful bateriological survey and test of the whole process was made and the original presence of bacteria demonstrated. It was shown that the battle against the bacteria could be won by chilling the hog carcasses rapidly to an internal temperature of about 34 deg. F. This temperature is to be retained if possible during the cutting up of the carcass. The meat should reach the curing cellar while still cold and should be started promptly on its cure in pickle solutions of adequate strength. Cleanliness at all times is desirable, but prevention of the growth of bacteria by refrigeration and salt is essential.

Meats are cured by salt either dry or in salt solutions. Such salt solutions for sweet pickled meats will contain sugar and a color fixing agent such as saltpeter. The packing house chemist has in recent years made a study of this process. He has found that the saltpeter may be replaced by the sodium salt or Chili saltpeter. Either of these nitrates is changed in the pickle solution to a nitrite and it is the nitrite that gives meat the familiar attractive color of cured meats. The nitrite combines with the hemoglobin of the muscle to form a nitroso-hemoglobin. This being the case the chemist has found that he can use sodium nitrite with excellent results Roughly, one-tenth as much material is required when nitrite replaces nitrate. Since now the nitrite only costs about twice as much as the nitrate the bill for this color fixing agent can be reduced to one-fifth of the former cost. Chemical control of a high order is required in the use of this new process.

The use of different sugars in the curing of meat has been studied chemically. Sucrose in the form of either cane or beet sugar is the sugar usually employed, although in his investigations the chemist has also tried dextrose, invert sugars, molasses and even a syrup made from raisins. Some of these sugars work well for certain cured products and one, at least, gives ham a most excellent flavor. At present studies are being made of the functions of all curing agents and the factors which may affect the penetration of curing agents into the meat.

ALL THE processes used reveal modifications or adaptations of engineering processes and machinery used in other industries. Low temperature vacuum drying is constantly being employed. The products are perishable. They must be processed fresh or kept from deterioration by quick chilling. Fats must be extracted, tissues ground and inert matter removed by sieves, and such materials as cholesterol prepared from proper solvents in the form of beautiful white crystals.

The story of the applications of chemistry and engineering to animal byproducts could fill a volume. Mere mention of a few byproducts which are finding new uses must suffice here. A certain tissue from part of the digestive tract of meat animals was once used as parchment covering for perfumery bottles and as goldbeater's skin in the preparation of gold leaf. These fine tissues have recently been used to line the gas tight compartments of airships such as the "Los Angeles."

From carefully selected beef blood such products as glue, sizing and leather fillers are produced. The properly treated, defibrinated, and centrifuged blood can be made to yield a beef albumin which has many of the desirable properties of egg albumin. Solutions of this albumin in water can be whipped just as can egg white.

GREAT strides have been made recently in the cure or alleviation of human ailments by means of products secured from the glands of animals. Every one knows how insulin is rendering diabetes a disease of much less dread consequences. The cretin may be helped by preparations from the thyroid glands of sheep. Liver extracts and preparations of red bone marrow and spleen are proving of great benefit in many cases of anemia. Many other products might be mentioned.

The control of humidity and other ventilation problems are now receiving the attention of the packing house technical men. Humidity and temperature control easily affect workmen, equipment and product and the amount of effective work done by workmen can be altered by this means. Moisture affects the corrosion of machinery. The drying out or shrink of the product and the growth of molds and bacteria can be readily affected by changes in humidity and temperature.

Packing houses now use artificial refrigeration. Ammonia gas is allowed to expand and is used in pipes directly or may be employed to cool brine solutions. These solutions may be pumped to the rooms needing refrigeration. Closed pipe systems have hitherto been standard. Recently, however, the chilled brine has been

sprayed from nozzles in brine lofts against baffle plates. By this means time reduction is effected, a lower and more uniform temperature is obtained and the shrink of the product is affected. This method has involved the redesigning of cooling plants and refrigeration rooms. Efficient air circulation is maintained by means of baffle plates and other details of the designing. Carcasses of meat can be more quickly and effectively chilled by this process. Older practice used to require 48 hours for the chilling of a hog carcass. Part of this delay was due to superstition and part to the process. Now the task can be accomplished in 24 hours easily.

SOMETIMES it is necessary to freeze meats to keep them, although frozen meats generally prove to be inferior to fresh meats. The freezing process has been studied by the technical man. By quick freezing at a low temperature and subsequent storage at a higher temperature the formation of ice crystals outside of the muscle tube can be controlled. Proper thawing will permit this moisture to be reabsorbed into the cell, thus doing away with the watery condition frozen meats have usually shown.

Refrigerator cars have always been chilled from ice bunkers supplied with ice and salt. The mechanical refrigeration of these cars is now a possibility in view of the advances that have been made in small types of mechanical refrigeration systems. Other possibilities lie in the use of solid carbon dioxide. Here we are glancing into the future, since the present price of this commodity limits its use. This product has a high heat absorbing capacity, changing from the solid to the gaseous state as it melts. Thus it leaves no liquid and does not cause the accumulation of water. Insulated containers for small shipments employing this so-called dry ice are an interesting possibility. Balsa wood is about the lightest known wood. Its tissue is full of air cells, hence boxes or containers made of it are not only light in weight but are also excellent insulators.

IN THE PAST it has been the practice to enclose sausages in animal casings. But just as silk was supplemented or replaced by rayon and other cellulose products competing with established materials, so now there are artificial sausage casings made from cellulose acetate. The new casings may be readily peeled off the frankfurter, leaving a pseudo-casing made of coagulated meat protein in its place. However, the new casing lacks elastic properties and it is also necessary to remove it before eating the product since the casing can not be chewed.

Some sausages are now produced without casings. The sausage meat is pressed into a metal tube which is heated. Soluble meat proteins come to the surface and here they are coagulated to form a self-casing or pseudo-casing.

Almost simultaneously with the introduction of artificial casings a number of sausage linking machines have been put on the market. This process had always been carried out by hand. Now it is possible to stuff the filling into the casing and then twist the casings into links by ingeniously devised machines.

The packing industry has an acute corrosion problem due to the almost constant presence of salt and water. Iron surfaces and the inside of iron pipes are easily affected by the combined action of these two. Non-corrosive metals are being studied, especially monel metal and the chrome steels. Corrosion in brine systems is influenced by impurities or the cautious addition of chemicals. This particular problem is inter-industrial and is being attacked co-operatively by two or three industries.

There are yet many other problems in the packing industry which are under study by the chemical engineer. A mention of these will serve to show the wide fields promising repayment for further technologic research: improved methods of dehairing hogs; cause of soft and oily pork; factors affecting the quality and palatability of meat; improvements in the curing of hides; studies of insulating material and methods of installation; synthetic ammonia and its economic effect on ammonia derived from packing house products; heat penetration and bacteriological studies in meat canning; handling waste waters and sewage; standardization of mechanical equipment; paints for use on damp walls in the presence of edible products; decreasing the weight of packages and boxes without decreasing the strength. It may be said with safety that few industries present as varied problems as does the meat packing industry. These are already being attacked by the chemical engineer and their solution is now only a matter of time.

Putting Out Oil Fires With Saltpeter

THAT water solutions of alkali metal compounds, particularly those containing oxygen, are unusually effective agents for extinguishing oil fires was publicly demonstrated at the recent St. Louis meeting of the American Chemical Society by Charles A. Thomas and Carroll A. Hochwalt of Dayton, Ohio. A satisfactory scientific explanation for this peculiarly interesting phenomenon is still lacking, although in reporting the results of their research the investigators referred to the method as a "catalytic" process.

While studying the effect of adding various chemicals to water to increase its effectiveness in extinguishing wood fires, it was accidently discovered that sodium-potassium carbonate would put out even a gasoline fire. Believing that this unusual effect was probably due to the blanketing effect of carbon dioxide liberated, the same experiment was tried with ammonium carbonate since it is more easily decomposed. It did not extinguish the fire nor did any other salts excepting those of the alkali metals. Work was then concentrated on these elements and it was found that potassium was much better than sodium and rubidium and caesium were progressively better than the two more common alkali metals.

Equally interesting was the discovery that all of the alkali metal compounds that contain oxygen have greater extinguishing effect than those without oxygen. This accounts for the fact that such oxidizing agents as potassium nitrate, potassium chromate and potassium chlorate are most effective. Strangely enough potassium perchlorate is better than potassium chlorate.

It is understood that a water solution of potassium lactate, because it is cheaper and less corrosive than other oxygen-containing compounds, is used in the first commercial extinguisher to apply this principle. When tested by the Underwriters Laboratory in Chicago such an extinguisher put out an artificial fire in 9 to 12 seconds while the shortest time with other methods was 35 to 45 seconds.

READERS' VIEWS AND COMMENTS

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Water Softening With Barium Salts

To the Editor of Chem. & Met.:

Sir—In his paper under this title in *Chem. & Met.* for April, 1928, C. J. Rodman apparently was not aware of the good work being done with barium carbonate in Western Australia. In the *Bull. Inst. Mining Met.* (London), December, 1927, V. T. Edquist, metallurgical chemist and superintendent for the Sons of Gwalia Gold Mining Company, tells of trouble with boiler water and how it was overcome. The mine produces salt water, which is used only in the ore-treatment plant, but water for boilers and domestic purposes is pumped from shallow wells. When used in its natural state this water is scale-forming and intensely corrosive. All methods of treating it failed until lime and barium were tried. Briefly, the method is to agitate the raw water with the requisite quantities of prepared crude caustic lime and finely pulverized (200 mesh) witherite (90 per cent barium carbonate). The reaction between the soluble sulphates in the water and solid barium carbonate in suspension is relatively slow, and agitation of each charge of water (14,000 gallons) takes 12 hours. Then the stirrers are stopped and the precipitate is allowed to settle. There are three treatment vats in the plant. A comparison of the raw and treated water follows, in grains per gallon:

Salt	Raw	Treated
$NaCl$	70.82	78.30
$MgCl_2$	33.03	None
$Mg(OH)_2$	.....	0.92
$CaCl_2$	26.98	55.94
$CaCO_3$	11.57	None
$CaSO_4$	22.71	None
CaO	.....	2.94
$BaCO_3$	.....	1.10
$Fe_2O_3+Al_2O_3$	2.10	None
SiO_2+insoluble	4.58	Trace

Close chemical control is essential, but the result of this treatment is that corrosion has ceased and boiler cleaning is a job of the past.

In the discussion of this paper it was stated that the process had been successfully adopted by the Federal Government for the water used in the locomotives of the Trans-Australian railway.

M. W. VON BERNEWITZ.
U. S. Bureau of Mines,
Pittsburgh, Pa.

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Installment Buying of Chemical Equipment

To the Editor of Chem. & Met.:

Sir—In the December, 1927, issue of *Chem. & Met.* an editorial referred to the possibility of buying chemical machinery on the installment plan, and of the benefits to the industry in general—to the buyer in that he could have his equipment and let it pay for itself, and to the seller in that he would have more business.

Equipment has been sold on the installment plan for a long time. Take the case of the railroads, probably the largest buyers of equipment in the world. They contract for locomotives, say, and to pay for them go out and sell a series of equipment trust certificates, which are first mortgage bonds, on the equipment itself, divided up into seventeen (usually) equal parts, with maturities of from one to seventeen years. So far as I know there has never been a default of either principle or interest on any such issue, largely because the courts have taken the common sense view that the railroads cannot run without equipment and it is to the advantage of all concerned to keep the records of these notes absolutely clear. So they sell at a very low rate of interest, and are "legal" investments in such states as Rhode Island and Massachusetts, where the bank laws are most strict.

AGRICULTURE is a seasonal problem. The cotton planter has one crop a year, and gets his money, if any, when he sells that crop. So he can only pay for whatever he needs once a year, and anyone doing business with him expects and is prepared to give long credits. That has led to the very extensive sale of farm tools on the installment plan. The farmer is used to mortgaging his property and then raising the mortgage little by little, so it was not a long nor a hard step to doing the same thing with his reapers and binders, the only difference being that the mortgage was held by the one who sold him the equipment instead of by the bank as in the case of the farm, and that the mortgage provided for a regular annual payment to reduce the principal, which is not always the case with real estate mortgages.

Those of us (the equipment manufacturers) who deal with the sugar people must conform to the credit habits of the countries where sugar is raised; and those habits are certainly installment habits. The usual terms are for the manufacturer to advance the freight charges, which are heavy, then receive 25 per cent of his bill for equipment and freight against the shipping papers, and three notes each for 25 per cent, but dated one, two and three years. Interest is usually at 8 per cent.

Naturally a customer's credit is well investigated, and one would think that an 8-per-cent note with a good name on it would be attractive for discount. But the National and State banks cannot take such long-time paper, and the manufacturer has to finance this out of his own credit, which may mean that he has nearly two years' total business to finance. While the banks will take such paper with the additional endorsement of the holder, that is not much help, as when the manufacturer puts his name on it, it becomes his liability as much as that of the maker of the note, and his credit is not at all improved. That puts a very heavy load upon him. The volume of business will not justify the acceptance plan that has worked so well in the automobile trade, and there is nothing else apparently that can be used.

There are, of course, export financing companies, and they do their work but cost a lot of money. One illustration will suffice. A lot of equipment to South America, running up into the tens of thousands of dollars, was sold on the basis of 25 per cent cash, 25 per cent notes for one, two and three years, and the export financing

people were called in. This was the first experience of this particular manufacturer in handling such business in any way except with his own credit, and it is possible that a more advantageous arrangement could have been made if his experience had been greater; but a very careful looking over the ground discovered nothing else better nor, for that matter, as good. The terms finally agreed upon provided that the finance company should pay 80 per cent of the face of the three notes at once and the balance as the notes were paid; that the manufacturer should indorse the notes, making them two-name paper; and that the finance company should receive the 8 per cent interest due, and some further charges that amounted to about six per cent. In other words, up towards fourteen per cent.

Last fall I heard a banker in St. Louis speak on export trade, and the next day went in to see him. I told him of this bit of financing just mentioned, and pointed out to him the very heavy disadvantage this put upon the American builder of equipment, for the European banks certainly make no such charges. He said that he thought the charge was very reasonable for the service rendered —that it cost a lot of money to get together the credit information necessary to advance any such credits—and that the banks could not take foreign risks for nothing —or even for 8 per cent. I asked him if the banks of this country were not interested in building up foreign trade, to which he of course answered, "Yes," but he could not see where that entered into it—all our competitors have the same handicap. Then I explained that the English banks finance such business for very much less money and our English competitors have that much advantage in going after such business. I wanted to know why, if the English banks could do it, we could not and his final answer was, "Well, the English have been at it for hundreds of years, and they know more about it than we do," which was as far as we got.

The manufacturer of equipment is only too glad to make terms to suit the conditions, and has been doing so for a long time. That means installment selling of equipment. But there is a lot of room for good banking service on this job, and there is an opportunity for some banker to make some good money out of it.

PHILIP DEWOLF.

Joubert & Goslin Machine and Foundry Company,
New York, N. Y.

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To the Editor of Chem. & Met.:

Sir—A recent editorial of yours, referring to installment selling of chemical engineering equipment was rather of a surprise to this office. We have applied installment selling to our business with complete success.

In this country the chemical industry is undeveloped, hence we do not confine ourselves to it alone, but are building all kinds of industrial plants. The money for such plants, when they are new, is always available, so that our difficulty is not with the new industries. Where we require all our persuasive powers is with the established industries, when we think we could improve results. The manager may accept our statements, but then counters with, "There is no money." Our reply is then, "We will make the investment, you to pay out of labor saved."

Viewed in the abstract, this offer is unrejectable. The difficulty may come in deciding just what the saving has been, but if we have been careful, the saving is so great that any difference of opinion means only a month more or less delay in final payment. We must take into account the probability of the continued operation of the factory, the relative importance of our offer compared to the capital of the company, and of course the credit and moral standing of the customer.

After several years' trial of this plan, we are all in favor of it. Based on our experience here I should expect to find thousands of opportunities in the United States, successfully made use of. However, I believe it is best applied by independent engineers who are at once the salesmen who write the contract, sign it, carry on all the correspondence and the conversations, then make the installation, put it in operation, make the tests for controlling the results and saving, and terminate the transaction by making the collection. In other words, I believe it would be extremely difficult to carry through such a transaction if handled in the usual way by all of the officers of a corporation. It is the ideal business for the free-lance engineer with the necessary financial backing, because he has the whole project in his own hands and the steps are therefore co-ordinated and unimpeded by red tape.

MARK R. LAMB.

Consulting Engineer,
Buenos Aires.

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Synthetic Ammonia Costs in America

Mr. Farley G. Clark has called attention to an error in the publication of his communication headed "Questions Cost of Synthetic Ammonia" which appeared on pages 236 and 237 of the April issue of *Chem. & Met.* The revision of "Table VIII," with its introductory sentence, should have been inserted after the paragraph ending at the top of page 237. The table was in this position in Mr. Clark's manuscript and should be so transposed in reading, to obtain the proper and intended sequence of his comments. THE EDITOR.

D.P.G. Rubber Accelerator Litigation Concluded

BY a decision of the United States Supreme Court, handed down by Chief Justice Taft on April 8, litigation on the validity of U. S. Patent 1,411,231 granted to Morris L. Weiss, covering the use of diphenyl guanidine as an accelerator in the vulcanization of rubber was brought to a conclusion. The Court declared the patent invalid, finding that the first discovery of the usefulness of D.P.G. as an accelerator was made by George Kratz in 1916 while he was employed by the Norwalk Tire and Rubber Company, in Connecticut. The plaintiff in the litigation was the Dovan Chemical Corporation, to whom Morris L. Weiss had assigned the patent now declared invalid. The defendants were the Corona Cord Tire Company of Butler, Pa., and the National Aniline and Chemical Company.

The Circuit Court of Appeals of the District of Columbia handed down a closely related decision on April 2, establishing the patent rights for the manufacture of diorthotolyl guanidine (D.O.T.G.) and triorthotolyl guanidine (T.O.T.G.) in favor of Winfield Scott and Ralph V. Heuser, respectively. The Scott application is assigned to E. I. du Pont de Nemours & Co. The T.O.T.G. application is held by A. G. Burrage, who is affiliated with the Portsmouth Dye & Chemical Company.

CHEMICAL ENGINEER'S BOOKSHELF

Pyrometry

PYROMETRY. By *William P. Wood* and *James M. Cook*. McGraw-Hill Book Co. New York. 1927. 207 pages. Price, $3.00.

RECOGNITION that the accurate measurement of high temperatures has assumed a primary importance in many of the industrial fields of today has been evinced in the publication of this compact but thorough volume. While the chief objective in the minds of the authors was the provision of a text book on pyrometry for use in connection with the courses on high temperature measurement frequently given at present, the practical viewpoint has nevertheless been maintained to the extent that the man in industry will find this an extremely useful reference work.

A discussion of temperature scales is followed by chapters on the various method of measuring temperatures with particular reference to the errors inherent in and the limitations of the several systems. Automatic controlling devices and temperature recorders, receive attention which may seem inadequate to the operating man, but the dual purpose of the book must be kept in mind.

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Electronic Theory of Valency

THE ELECTRONIC THEORY OF VALENCY. By *Nevil Vincent Sidgwick*. Oxford University Press, American Branch, New York. XI + 310 pages. Price, $5.00.

Reviewed by LOUIS KAHLENBERG

EVER since the promulgation of the atomic theory by John Dalton valency has been an important subject for discussion in chemistry. The valency of an element is a highly specific property, and attempts to account for such properties by means of mechanical theories have thus far been quite unsuccessful. It was to have been expected that the electronic theory of matter would bring with it renewed attempts to explain the valency of the chemical elements. Dr. Sidgwick has given us a very readable presentation of those attempts. His book, moreover, deals not only with valency, but presents all of the various phases of the electronic theory which are necessary in order that the reader may comprehend the explanations of valency on the basis of that theory. So in the fifteen chapters of his book Dr. Sidgwick deals with such subjects as: Nuclear Atom and Atomic Number; The Bohr Theory—the Hydrogen Atom—Atomic Structure and the Periodic Classification; The Fundamental Principles of Valency and the Periodic Table; Electrovalency and Covalency; Co-ordination; Molecular Association; Solvation; Atomic and Molecular Magnetism; Stereochemical Relations; Chelate Rings; and Periodic Groups.

As to the conclusions reached, it might be well to quote from page 182:

"We have so far been engaged in disentangling the different forms of valency, in discovering their electronic mechanism, and in discussing the conditions of their formation. We can now describe the state of a combined atom in terms of its electrovalency, its normal covalency, and its co-ordination. It is worth considering what remains of valency in the older sense, as representing a state of the atom giving it a definite power of chemical combination. Can we speak absolutely of the valency of an atom in a compound, and if so, how can we define it in terms of the electronic structure? No completely satisfactory answer can be given to this question. The modern distinction of different types of valency shows that the combining power of an atom may be due to more than one cause and may arise in more than one way, and it is not possible to express all the variations of this power as numerical values of a single constant. This is largely due to the complications introduced by the existence of mixed valency groups. On the whole the best definition of absolute valency seems to be that adopted by Grimm and Sommerfeld, that it is numerically equal to the number of electrons of the atom 'engaged' (*beansprucht*) in attaching the other atoms. It is thus equal to the difference between the atomic number and the number of unshared electrons in the combined atom."

And again on page 183 Dr. Sidgwick remarks: "In general then it may be said that if a definition of absolute valency is needed, the best that can be given is that it is equal to the change in the number of unshared electrons caused by the combination."

These passages will serve to give the reader an idea of the concepts of valency to which the electronic theory has led. Any theory must finally stand or fall by the new avenues of experimental work that it suggests. It remains to be seen whether the electronic theory of valency will lead to new experimental discoveries in chemistry.

Dr. Sidgwick's book is clearly written and from cover to cover reflects his enthusiasm for the new theory. It is highly commendable. The physical features of the volume are excellent.

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Artificial Minerals

THE OPTIC AND MICROSCOPIC CHARACTERS OF ARTIFICIAL MINERALS, WITH DETERMINATIVE TABLES. By *Alexander N. Winchell*. University of Wisconsin Studies in Science, Number 4. Madison, Wis. 1927. xv + 215 pages. Price, $1.50.

Reviewed by E. M. CHAMOT

THIS COMPILATION of the optic constants and microscopic characters of all the inorganic salts whose indices of refraction have been measured, will be welcomed by all those who employ microscopic analytical methods. To Professor Winchell our thanks are due for his painstaking care and for the admirable manner in which the data have been presented.

The "Determinative Tables" are the first really workable tables that have been published. They are so ingeniously arranged that the investigator is enabled to identify a salt with comparative ease and dispatch.

The compounds whose constants are given, have been grouped in the main in accordance with the classification established by Dana. For each one there has been given

the chemical formula, crystal system, physical properties (habit, cleavage, hardness, sp.gr., etc.), orientation, extinction angles, refractive indices, birefringence, optic sign, optic angle, dispersion, etc., and in most instances the mode of formation. Special data are also given when available.

A novel feature of the handbook and one which will be greatly appreciated by the chemists is the double indexing of the compounds, once under their chemical names, and then again under their formulas. If the salts are also to be met with as natural minerals, the mineralogical name is also indexed. A further commendable feature is the use of "condensed" formulas instead of the "extended" formulas so often used by mineralogists: formulas which usually annoy us and force us to employ pad and pencil before we can be sure what the compound really is.

It is refreshing to read, "The ordinary practice of considering that a natural mineral is a definite chemical compound is quite misleading, since such a condition is rare among natural minerals, nearly all of them being composed of two or more chemical compounds in mutual crystal solution. Since natural minerals vary thus in composition, they also vary in optic properties." One might think that a chemist had written this instead of a mineralogist.

Professor Winchell's conversion is not yet quite complete, however, for he employs some formulas open to question and we chemists cannot be quite reconciled to the title of his book "*artificial minerals.*" Doubtless this is only another illustration of the limitation of the English language. We have had our quarrels over "artificial ice," "artificial silk," "artificial ruby" and now there appear to be legitimate grounds for protesting against the general term "artificial mineral" in the sense here used. The reviewer believes that most analytical chemists reading the title of the book will doubtless misinterpret its scope and pass it by without realizing how serviceable it might be in their work; for had Professor Winchell done nothing more than publish his "Determinative Tables" he would have made data available that is invaluable to all analysts.

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Detection by Radio-Elements

RADIO-ELEMENTS AS INDICATORS. By *Fritz Paneth.* The George Fisher Baker Non-Resident Lectureship in Chemistry at Cornell University. McGraw-Hill Book Company, New York. 1928. 164 pages. Price $2.50.

Reviewed by D. B. KEYES

PROFESSOR PANETH has written a most entertaining book covering subjects to which he has contributed a great deal from his own investigations.

The chief topic concerns the use of radio elements as indicators, especially in analytical chemistry. The author has an exceedingly pleasing style and clearly describes the functions of these radio-active elements. Though the desired analytical result may be too faint or imperceptible for direct detection, the radio-element, due to its sensitizing action, makes the substance appear, even in minute quantities. Isotopic elements are chemically inseparable and the inactive element is thus always revealed by its active isotope. The sensitivity lasts as long as the radio-activity of the latter.

Through this remarkable "visibility," then, of minute quantities of radio-active elements, there have been built up by Professor Paneth and others very unique and satisfactory means of analyzing extremely small quantities of inactive elements. This has made possible the discovery of the existence of a great many compounds hitherto unknown.

Besides the subject of radio-active elements as indicators, Professor Paneth describes the properties of the little known volatile hydrides and concludes, in Part 3, with a discussion of the natural system of the chemical elements. His speculations regarding the existence of an element with "zero serial number" and the existence of elements with a higher serial number than 92 are especially fascinating and worth the consideration of the scientific world.

In brief, this little book will please and entertain the reader besides well repaying him for the time spent in its perusal.

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STANDARDS AND TESTS FOR REAGENT AND C. P. CHEMICALS. Second Edition. By *Benjamin L. Murray.* D. Van Nostrand Company, Inc., New York. 1927. 560 pages. Price, $5.00.

The author, for many years associated with one of the country's largest manufacturers of reagent and C.P. chemicals is well qualified to extend the scope of his previous book by the addition of standards for chemically pure materials. These, together with the revised older material in the form of tests for some hundreds of laboratory reagents, will serve well as a means for calibrating the laboratory standards of the chemical industries.

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SPECTROSCOPY, VOL. II AND III. Third Edition. By *E. C. C. Baly.* One of the series of "Text Books on Physical Chemistry" edited by *Sir William Ramsay* and *F. G. Donnan.* Longmans, Green and Company, New York. 1927. 398 and 532 pages. Price, $6.00 and $7.50 respectively.

This notable work, now in its third edition and fourth printing brings up to date our present knowledge of the study of atom structure through spectroscopic means. The work of earlier experiments is correlated with recent findings of physicists and astronomers in a most thorough manner. Particular attention is given to the Bohr theory of spectra and its influence in placing the science upon a firm mathematical basis as well as in its relation to the Stark and Zeeman effects and the theory of emission band spectra. A fourth volume to follow will deal principally with absorption spectra and the shifting of spectrum lines due to pressure and motion.

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THE MICROBIOLOGY OF CELLULOSE, HEMICELLULOSES, PECTINS AND GUMS. *By A. C. Thaysen* and *H. J. Bunker.* Oxford Univ. Press, American Branch, New York. 1927. 363 pages. Price, $8.50.

Those prophets who acclaim the future ascendancy of the biochemical engineer should add this volume to their libraries. For the non-biologist the work will be found most taxing to his patience, but should he survive its thirteen chapters he is certain to emerge with a new respect for microscopic organisms and with some inkling of the rôle that biochemical processes will one day play in the world's affairs.

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MECHANICAL WORLD YEARBOOK. Emmott and Company, Ltd., Manchester, England. 1928. 348 pages. 1s. 10d.

An annually published diary and mechanical engineer's handbook of pocket size. Much material has been added since the previous volume was issued, keeping the contents in line with the developments of the year.

Selections from Recent Literature

FRACTIONATING. C. S. Robinson. *Chemistry & Industry,* April 20, pp. 405-8. Problems in the design and construction of fractionating stills are discussed. Twelve generalizations are stated concerning the behavior of mixtures toward fractional distillation. These rules are based on experience with binary systems, but are applicable to mixtures of any degree of complexity, e. g. petroleum oils. Illustrated with curves and diagrams.

OXIDIZING HYDROCARBONS. E. B. Maxted. *Journal of the Society of Chemical Industry,* April 20, pp. 101-5T. The vanadates of Sn and Bi have been found to be active catalysts of atmospheric oxidation of aromatic hydrocarbons and the like. For example, benzoic acid can be made from toluene, benzyl alcohol or benzaldehyde by this means; and tetrahydronaphthalene yields chiefly phthalic anhydride. Since air is the cheapest oxidizing agent, use of these vanadate catalysts shrould be extended. Illustrated with curves and diagrams.

SODIUM SULPHIDE. Peter P. Budnikoff and E. Shilov. *Journal of the Society of Chemical Industry,* April 20, pp. 111-3T. In the reduction of Na_2SO_4 to the sulphide by H_2 and CO, Ni and its compounds are effective catalysts. Pure CO and pure sugar carbon separately do not reduce the sulphate at moderate temperatures. Reduction by H_2 begins above 700 deg. C. At about 1,000 deg. C. or higher the sulphide itself begins to reduce the sulphate.

SUPER-CENTRIFUGE. H. Winckelmann. *Chemische Fabrik,* April 11, pp. 193-5. Illustrated description of the construction and operation of the long drum type of machine known as the super-centrifuge. These machines are nearly automatic and quite safe to operate. In spite of the long rotor and high speed there is no vibration and little noise. The range of uses is greatly extended by special fittings, e. g. a gas-tight hood for protection of volatile or oxidizable liquids.

GAS CONTROL. Albert Herberholz. *Chemische Fabrik,* April 11, pp. 196-8. The Junkers automatic calorimeter for continuous measurement and recording of the heating value of gas has been developed to the point where it becomes a reliable aid in controlling the thermal value of a gas plant's output. It is also useful in following the course of coke oven performance. Illustrated.

ALUMINUM WARE. H. Buschlinger. *Chemische Fabrik,* April 18, pp. 209-11. A discussion of the use of Al and its alloys in apparatus construction and in making cooking ware and food containers. Some precautions needed in the making and use of Al foil food wrappers are outlined.

SULPHURIC ACID. Arthur Grounds. *Industrial Chemist,* April, pp. 155-8. Illustrated description of a new acid plant operating the Schmiedel-Klencke system (a modified chamber process). The plant operates steadily and with very little labor (only two attendants).

GASOLINE FLOW. Bruno Miller. *Chemiker-Zeitung,* April 11, pp. 290-1. In a study of the rate of flow of gasoline through a vertical 5-meter pipe it was found that in 1-in. and ¾-in. pipe the flow is not much faster at the bottom than at the top and the rate of 4 m. per sec., considered the maximum safe speed above which excessive charges of static electricity will be generated, was not attained. In ½-in. pipe this rate of flow was exceeded.

DRIER. *Chemiker-Zeitung,* April 11, p. 291. Illustrated description of a rapid drier for color pastes, in which the steam consumption is only 1.5 to 2.3 lb. per lb. of water evaporated, instead of the 10 to 15 lb. consumed by the older types of driers.

LEATHER SCRAP. Hermann Stadlinger. *Chemiker-Zeitung,* April 18, pp. 305-7. A review of methods for working up scrap from chrome tanned leather into byproducts. These include glue, fertilizer and chrome alum. Many patents on glue recovery are cited, and the new Ellenberger-Schrecker method is discussed.

ROSIN ESTERS. Ewald Pyhala. *Revue des Produits Chimiques,* March 31, pp. 201-3. A new method of esterifying rosin by boiling with dry Ca glycerolate (or other Ca alcoholate or phenolate) is described. The method has been applied to rosin mono- and triglycerides and to its phenyl, cresyl, naphthyl, resorcyl and bornyl esters. The products are useful in varnishes to resist solvents such as alcohol, gasoline and turpentine.

GLASS FURNACE. D. J. McSwiney. *Glass,* April, pp. 155-6. Proper regulation of combustion conditions in glass furnace operation has a greater significance than mere economy in fuel; the color and quality of the glass in the furnace depend much on the character of the flame and the composition of the combustion gases; for example, clean color is favored by a strongly oxidizing flame.

BRASS INGOTS. G. L. Bailey. *Metal Industry,* April 6, pp. 351-2. In a study of the influence of dissolved gases on the soundness of 70:30 brass ingots, it is concluded that 70:30 brass is not liable to unsoundness due to dissolved gases. Special methods of casting were established by which brass can be safely cast from only 30 deg. C. above the liquidus point.

CENTRIFUGAL MIXERS. Ernst Buhtz. *Chemische Fabrik,* April 18, pp. 211-3. Illustrated description of a mixer construction having one or more mixing disks mounted on a shaft. This type of mixer is useful for simple mixing operations such as blending liquid fuels, but also for effecting chemical reactions. The mixer can even be adapted to continuous working with a time reaction.

HEAT RESISTING PAINTS. F. T. Walker. *Industrial Chemist,* April, pp. 138-40. Of the various types of heat resisting paints (which are briefly reviewed) the best all-around results have been with an Al pigment in an old medium. Silicate paints are the ideal heat resisters, but have some serious disadvantages. Graphite retards drying and so is not satisfactory in paints with drying oil base.

ALCOHOL. *Industrial Chemist,* April, pp. 141-9. Illustrated account of the methods and equipment in use in a new plant for large scale production of industrial alcohol. Elaborate precautions for keeping the yeast culture pure are necessary. Transporting and mixing of liquids are effected mainly by gravity or compressed air; machinery requiring attention or labor is eliminated where possible.

SULPHUR. Paul Mondain, Monval and Paul Schneider. *Comptes Rendus* 186, 751-3 (1928). In connection with the use of molten S as a heating bath or heat transfer medium, it has been found that the transition temperature of S (liquid) to S (viscous), which is normally 160 deg. C., can be shifted to higher and higher temperatures by addition of suitably chosen foreign substances. The shift continues until a new phase is formed. For example, with triphenylmethane it is possible to raise the transition temperature to above 200 deg. C.

AMMONIA. Leonid Andrussow. *Zeitschrift für angewandte Chemie,* March 10, pp. 262-3. A kinetic explanation of the ammonia oxidation reaction is proposed. It does not, however, explain the true reason for the behavior of the catalyst; it is not yet known precisely why such a remarkable activation of ammonia at the catalyst surface occurs.

FERTILIZER. Weller. *Zeitschrift für angewandte Chemie,* March 3, p. 238. Application of nitrogenous fertilizers to grass lands is a paying proposition. Thus, the Bavarian Agricultural Experiment Station has found, in a study of the effects of the judicious application of the various types of fertilizers, that 1 lb. of added nitrogen increased the hay crop 32 lb.

AMMONIA. A. Mittasch, L. Kuss and O. Emert. *Zeitschrift für anorganische Chemie 170,* 193-212 (1928). It has been found that the complex Fe cyanides, used as catalysts in ammonia synthesis, are not in themselves catalytic to the reaction; decomposition or reduc-

tion products, which must contain metallic iron, are the true catalysts. Illustrated with curves and data.

BERLIN BLUE. B. Ormont. *Zeitschrift für Elektrochemie*, March, pp. 106-11. Berlin blue can be successfully and economically made by a method in which K_4FeCy_6 is electrolyzed with an iron anode. A sodium salt is chosen for the intermediate electrolyte. Current density may be as high as 100 amp./sq.dm. The current yield, under suitable conditions, is 99-100 per cent.

PAINTING CONCRETE. V. Scheifele. *Farbe und Lack 1928*, 104-5. Satisfactory and durable paint coatings are important but not easy to obtain on concrete, mortar, plaster and the like. The chemical composition of the material, and its probable effect on the coating, must be considered. Some directions for obtaining good protective effects on such surfaces are given. Necessary precautions are also stated.

WOOD SUBSTITUTES. A Bergami. *Revue générale des matières plastiques*, March, p. 91-2. A review of the production of substitutes for wood, with or without the utilization of wood wastes such as sawdust. Materials used in such compositions include blood glue, casein or the like, lime and water glass.

FERROCHROME. K. T. Kürten. *Zentr. Hütten- und Walzwerke 32*, 15-9 (1928). The costs of the alumino-thermic method of making Fe:Cr metal are too high to allow the advantages of the process to be utilized. Hence ferrochrome is generally made in the electric furnace, in which alloys with 60 to 70 per cent Cr and any C content can be made. Average data are cited for several procedures.

DRYING PAPER. *Le Papier*, Feb., pp. 85-7. The drying conditions required to produce a given effect in drying paper can be calculated with a fair degree of precision and certainty. Some formulas for such calculations are given, including that of Mallickh for figuring dry paper output.

DULCIN. Kurt Täufel, C. Wagner and H. Dünwald. *Zeitschrift für Elektrochemie*, March, pp. 115-27. To ascertain whether synthetic sweetening agents are effective if heated in foods or beverages, trials were made with dulcin (p-phenetylurea), which is generally considered to be stable in boiling water. Cooking experiments revealed considerable decomposition, accelerated by organic acids, slightly retarded by soda or mild alkali. Dulcin should not be added to cooked foods or beverages till after heating.

WATERPROOF PAINT. J. Sch. *Farbe und Lack, 1928*, 107-8. The reason for the superiority of tung oil paints over others in the matter of water resistance is that the film is practically one continuous phase of oleogel, whereas in films from linseed and other paint oils there is water soluble matter which favors water permeability.

Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from Bureau responsible for issue.

Preliminary Report of the Census of Dyes and Other Synthetic Organic Chemicals—Record Production of Dyes in 1927. Mimeographed document issued by U. S. Tariff Commission.

Trade Practice Conferences. Unnumbered document of the Federal Trade Commission, dated March 15, 1928. 15 cents.

Tensile Properties of Soft Rubber Compounds at Temperatures Ranging from —70 deg. to +147 deg. C., by R. F. Tener, S. S. Kingsbury, and W. L. Holt. Bureau of Standards Technologic Paper 364. 10 cents.

Unusual Features in the Microstructure of Ferrite, by Henry S. Rawdon and Torkel Berglund. Bureau of Standards Scientific Paper 571. 35 cents.

Endurance and Other Properties of Rail Steel, by John R. Freeman, Jr., R. L. Dowdell, and William J. Berry. Bureau of Standards Technologic Paper 363. 35 cents.

Creep in Five Steels at Different Temperatures, by H. J. French, H. C. Cross, and A. A. Peterson. Bureau of Standards Technologic Paper 362. 15 cents.

Explosibility of Sulphide Dusts in Metal Mines, by E. D. Gardner and Edmund Stein. Bureau of Mines Serial 2863.

Flotation of Low-Grade Phosphate Ores, by H. M. Lawrence and F. D. DeVaney. Bureau of Mines Serial 2860.

A Rapid Corrosion Test for Gasoline, by H. P. Rue. Bureau of Mines Serial 2862.

Propagation of Flame in Mixtures of Natural Gas and Air, by H. F. Coward and H. P. Greenwald. Bureau of Mines Technical Paper 427. 10 cents.

A Comparison of the Results Obtained With the Oxygen-Bomb and Carius Methods in Determining Sulphur in the Heavier Petroleum Oils, by John M. Devine and F. W. Lane. Bureau of Mines Serial 2866.

Tabulated Analyses of Representative Crude Petroleums of the United States, by N. A. C. Smith and E. C. Lane. Bureau of Mines Bulletin 291. 15 cents.

Seventeenth Semi-Annual Motor Gasoline Survey, by E. C. Lane, Peter Grandone, and D. B. Taliaferro, Jr. Bureau of Mines Serial 2861.

Methods of Dealing with Paraffin Troubles Encountered in Producing Crude Oil, by C. E. Reistle, Jr. Bureau of Mines Technical Paper 414. 15 cents.

Coal in 1925, by F. G. Tryon and L. Mann. Bureau of Mines Mineral Resources separate. 25 cents.

Sulphur and Pyrites in 1926, by C. E. Julihn and H. M. Meyer. Bureau of Mines Mineral Resources separate. 5 cents.

Cement in 1926, by B. W. Bagley. Bureau of Mines Mineral Resources separate. 10 cents.

Mineral production statistics for 1927—preliminary mimeographed statements from Bureau of Mines on: Magnesium, Fluorspar, Aluminum, Asbestos, and Talc.

Power Capacity and Production in the United States, by C. R. Daugherty, A. H. Horton, and R. W. Davenport. U. S. Geological Survey Water-Supply Paper 579. 30 cents.

Experimental Tapping of Hevea Rubber Trees at Bayeux, Haiti, 1924-25, by Loren G. Polhamus. Department of Agriculture Technical Bulletin 65. 5 cents.

Dust Control in Grain Elevators (Methods applicable to many industries), by Hylton R. Brown and J. O. Reed. Department of Agriculture Department Bulletin 1373. 15 cents.

British Chemical Trade in 1927, by Homer S. Fox. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 545. 10 cents.

The Fish Meal Industry, by J. A. LeClerc. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 538. 10 cents.

New German Pharmaceutical Preparations—1927, by Consul Hamilton C. Claiborne, Frankfort on the Main, Germany, Bureau of Foreign and Domestic Commerce Chemical Division mimeographed circular 195.

Profitable Year 1927 for Swiss Dye Manufacturers, by Consul C. M. Hitch, Basel, Switzerland. Bureau of Foreign and Domestic Commerce Chemical Division Special Circular 196.

International Chemical Negotiations With Particular Reference to Dyes, by Consul H. C. Claiborne, Frankfort on the Main, Germany. Bureau of Foreign and Domestic Commerce Chemical Division Special Circular 189.

Improvement in the Dye and Synthetic Organic Chemical Industries in Italy, by Assistant Trade Commissioner E. Humes, Rome. Bureau of Foreign and Domestic Commerce Chemical Division Special Circular 188.

Paint and Varnish Production and Sales: 1927, Last Six Months. Production figures in mimeographed form from the Bureau of the Census.

The Practical Application of Two Qualitative Tests for HCN in Ship Fumigation, by G. C. Sherrard. Article in Public Health Reports, of the Treasury Department, April 27, 1928.

THE PLANT NOTEBOOK
an exchange for OPERATING MEN

Transporting Open Barrels

By R. M. Thomas
Denver, Colo.

An occurrence which is as annoying as it is frequent is the necessity for transporting an open barrel of some liquid to another point in the plant. As it is never expected, the chances are always against there being proper facilities for handling the material in other than a sloppy and wasteful manner. A device that is so simple that it is not likely to be thought of, and yet which is nearly as effective as a tight cover on the barrel, consists in placing a number of blocks of wood on the surface of the liquid. As the blocks float, they effectively prevent the formation of the little waves which so soon grow into bigger ones to the sorrow of the man who is trying to move the barrel.

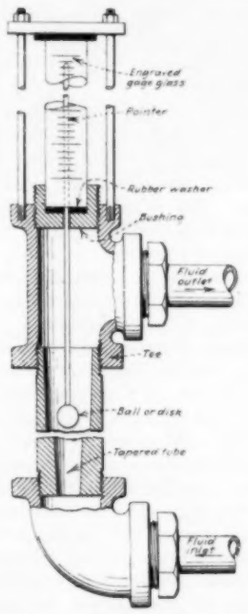
Indicating Flow Meter

Of the two types of flow meters most commonly used in the chemical plant, those that operate through displacement and those that give flow rates through the measurement of differential head, the former are largely adapted to integrating the flow rate over long periods of time, while the latter are used to determine instantaneous flow volume.

The first type is usually of no particular value in the control of a continuous process, except for matters of record. The second, however, is used in its many variations for governing the flow of fluids of all kinds. Such meters ordinarily use a Venturi, an orifice, or a pitot tube and measure the pressure differential with a Bourdon tube or liquid column.

For flow in considerable quantity of only moderately viscous materials, such meters are quite accurate. When it is necessary to measure extremely small flows, especially of a very viscous material, a different kind of meter is preferable. This is what is called the float meter. The principle has been adapted to the measuring of flow rates of steam and gases, and through certain constructional changes may be used for liquids.

The meter to be described was developed to determine the instantaneous delivery rate fluctuations in a line carrying an extremely viscous liquid which flowed at the very low rate of less than 10 c.c. per min. With slight changes in construction, the meter may be adapted to measure either less or much greater flow with considerable accuracy. In addition, it is self-contained and may be easily constructed in any plant shop or experimental laboratory. This type of meter may be used for determining an almost imperceptible flow rate to laboratory apparatus, as small even as a few drops per minute. Or it may be constructed to measure gallons per minute in the plant. It is practically instantaneous in its response to changes in flow and gives the reading without the necessity for waiting for oscillation to die as the meter is self-damping.



Easily Constructed Float Type Flow Meter

Offsetting the meter's good points are two disadvantages which are not at all insuperable. The characteristics of the meter are not susceptible to easy calculation, for which reason each meter of different physical construction must be calibrated. In the second place, changes in viscosity affect the accuracy of the meter. Where these are considerable, as with very decided temperature variations or a change to a fluid of quite different viscosity, as for instance, from water to a gas or to oil, recalibration will be necessary.

One form which this meter may take is shown in the drawing. The principle will be evident from brief consideration of the action of a body falling through a fluid. If a constant force, such as gravity, tends to move a body through a fluid, the body will attain a velocity which will be balanced by the viscous resistance and inertia of the fluid. If the fluid moves at a velocity equal and counter to the body, the latter, of course, remains stationary with respect to the observer. The result is obtained, as in the drawing, by floating the body in a tapered bore, so that it may seek an area where the fluid velocity will balance the falling rate. The fluid flows upward against the body, in this case a metal ball attached to a pointer. The ball rises or sinks into a section of the taper, which corresponds to the fluid velocity, showing every velocity fluctuation.

Where extreme accuracy is required, the range of the instrument is necessarily limited. Such accuracy may be made as great as desired by using a sufficiently finely tapered bore. If, however, a greater range is required, the taper variation must be increased. This may be done by increasing the length of the instrument, or by sacrificing a certain degree of accuracy. The taper, in any case, must be determined experimentally for the fluid in question, as there is not sufficient data available to indicate more than roughly the dimensions of the instrument for any particular use. A fairly safe rule for the average case is to choose the large end of the taper equal to about one and one-half times the diameter of the pipe for pipes up to 1-in., and for medium velocity. For low velocities, or for larger pipes, the large end should be equal to or smaller than the diameter of the pipe. For viscous liquids, the taper portion must be large enough to keep the liquid velocity down to a few feet per minute in the meter cylinder. The small end of the taper will be governed in size by the lower limit of the flow.

The construction is readily apparent from the illustration. Extra heavy pipe for the taper tube, pipe fittings, a piece of gage glass, and some miscellaneous odds and ends of metal and rubber, together with a ball or disk for the float, are all that is necessary. If the range of the completed instrument is not satisfactory, another float of different size may be used, or the upper end of the pointer may be weighted to give suitable readings. Another construction, which may be made by any glass blower, is inserted directly in a vertical run of any line not under high pressure. It consists of a tapered length of glass tubing formed over a previously prepared tapered mandrel. A small ball of colored glass, or some other opaque, corrosion-resisting material placed inside the tube, completes the meter. No pointer is required in this case, as the top of the ball serves as an indicator of the flow which is read directly from the calibration marks on the tube. The mechanical difficulties in building a meter for acid are thus avoided.

Overhead Distribution Feeders That Carry Current to the Vorce Chlorine Cells At Westvaco Chlorine Products, Inc.
The method of splicing these heavy copper rods is described in the accompanying note. Another interesting feature of the installation is the method of supporting the rods. The rods themselves are arranged on 4-in. centers and are threaded at 10-ft. intervals through ebony asbestos panels 1 to 1½ in. thick. The panels are supported from the building steel.

Splicing Copper Rod Feeders

A very satisfactory method of splicing the copper distribution rods used to carry current to the Vorce chlorine cells in the plant of Westvaco Chlorine Products, Inc., at South Charleston, W. Va. was developed by the H. K. Ferguson Company, Cleveland. The Vorce cell, (see *Chem. & Met.*, Vol. 35, No. 3, Mar. 1928, pg. 158 ff.) operates at about 1,000 amp., and 250 volts for each series of 70 cells. This necessitates the specially designed distribution feeders carried in an overhead system, shown in the accompanying photograph. The feeders consist of bare copper rods varying from 1 in. to 1⅛ in. in diameter. They were designed to give uniform voltage drops at the terminals. The joints were made by the use of split copper sleeves fashioned from extra heavy copper tubing. The pieces of tubing were split their full length and then slipped over the ends of the rod feeders and soldered into place. When tested for conductivity, these joints were found to average from 25 to 33 per cent better than an equivalent length of rod.

Eliminating Bubbles in Fabric Impregnation

By A. F. Randolph
Du Pont Viscoloid Company

In the commercial impregnation on fabrics or paper with viscous mixtures, various means are taken to prevent the inclusion or entrapment of air, which might spoil the appearance of the product or impair its impermeability. A simple method of accomplishing this, which has been used successfully and found practicable, is to displace the air from the fabric by saturation with a mobile liquid and to pass the fabric, while still wet, into the impregnating bath. The liquid of the preliminary dip must be a light mobile one, such as water or the ordinary solvents, and it must of course be compatible with the impregnating dope. Preferably it should be a solvent for the impregnating material and also preferably it should be volatile, as it is ordinarily desirable that it be subsequently removed from the impregnated fabric. Volatility, however, is not essential. For example, the dip preliminary to impregnation with a nitrocellulose dope would ordinarily be a volatile solvent such as acetone, but it is feasible to use a non-volatile mobile liquid such as triacetine, either alone or in mixture with a more volatile liquid, with the result however of softening the subsequent coating somewhat, much as though the non-volatile substance had first been incorporated in the dope.

This method is used to advantage in impregnating paper with pyroxylin compositions. If the paper be immersed dry in pyroxylin dope, the dope because of its viscous nature will enclose and trap air in the interstices, and thus even though the dope has previously been freed of bubbles and dissolved air, the product will be marred by bubbles. When, however, the paper is given a preliminary dip in, for example, acetone, so that the interstices become filled with liquid instead of air, and the paper while still wet is passed into the dope, there is no entrapment of air and, provided of course that the subsequent drying be carried out properly, no bubbles will develop.

Planning Board for Batch Control

A planning device that is available for scheduling and indicating batch progress may be simply constructed according to a scheme similar to the planning board used in Taylor System shops. A board of suitable size is marked off in horizontal rows for days of the week, and in vertical columns for departments or pieces of apparatus. Small disks of metal, of different colors to denote various materials may be hung on hooks that are placed in each space on the board. These disks are large enough to allow writing on any important data such as amount of material to be handled and the treating cycle.

The scheme is especially adapted to works in which the production is not continuous and uniform. When a given batch is started in a given department a disk is placed on the board. As the batch progresses, the position of the disk is changed. A glance indicates exactly what condition prevails in each department at all times.

Oxy-Acetylene Lance

A practical "wrinkle" which is capable of saving much time in many instances where a deep hole must be drilled in a large piece of metal has been described in *Oxy-Acetylene Tips*. The case was cited of a sulphur company which required as a well drilling tool a piece of 8-in. chrome nickel steel shafting, 30 in. long with a 2¼-in. hole through the center. The operation of drilling the hole took 8 hours when done in the lathe. With the substitution of the oxygen lance, time was reduced to a matter of minutes. In brief, the equipment consisted simply of a cylinder of compressed oxygen provided with a reducing valve and a length of hose. The lance proper was nothing more than a piece of steel pipe fitted to the hose, from which a stream of oxygen might be directed. In using the lance the spot to be pierced is first heated red hot, preferably with an oxy-acetylene flame. Then a stream of oxygen is allowed to flow through the lance, striking the heated spot on the surface of the metal. The metal and pipe burn away continuously, keeping the cut going from the heat of the burning.

EQUIPMENT NEWS *from* MAKER *and* USER

Filter for Dewatering Salt

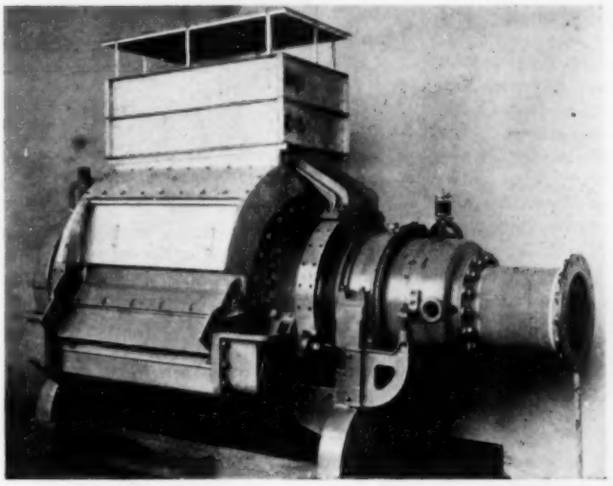
By D. F. IRVIN
Oliver Continuous Filter Company

Most of the salt produced in this country is destined for domestic use and is made by multiple-effect vacuum pan evaporation of brines from drilled wells. Salt strata underlie various sections of the country, in particular being found in Michigan, Kansas, Ohio, New York and Louisiana. The salt is usually recovered in the form of brine by the process of forcing water down from the surface and dissolving the salt. In the coastal regions, however, considerable salt is made by solar evaporation of sea water. The product of this evaporation contains impurities which are removed upon solution and recrystallization. This dissolved product is evaporated by methods similar to those used by inland salt plants.

As salt is ordinarily found in a state of high purity, with a small percentage of calcum sulphate representing practically the only foreign solid, the usual sequence of steps in salt manufacture is simple. Raw brine is fed to the evaporators which produce crystals of the desired size. When the proper stage is reached, the salt and mother liquor are removed from the evaporator by a centrifugal pump or drag elevator to equipment which separates the crystals from the residual brine. The crystals are washed and dried as nearly as possible in this equipment, after which they may pass to storage, later to be sent through rotary kiln dryers to remove the remaining moisture before the salt is packed in containers for shipment.

The established practice in separating the crystals from the mother liquor and partially drying them, has been to use high speed, intermittent type centrifuges. These are designed for manual operation and produce a salt of 3½ to 4 per cent moisture. During the past year, however, 14 of the largest salt producing companies of the country have standardized on the use of the new Oliver salt filter.

The new filter retains the principles of the standard Oliver, but has been modified in various details to adapt it to the dewatering of salt. The 4x6 ft. salt filter is shown in the accompanying illustration. Internal passages have been modified to permit the attainment of large capacities with low vacuum requirements. The 12 sections into which the filter surface is divided communicate with triangular passageways within the body of the drum, which in turn lead through large cored holes in the trunnion to the port valve shown at the extreme right of the filter. The passageways are sufficiently large so that with a maintained vacuum of but 2 to 3 in., capacities of two to four tons of salt per sq.ft. of filtering surface per 24 hours are possible.



New Salt Filter with Capacity up to 300 Tons per Day

In addition to this change over the standard Oliver filter, other notable differences lie in the oscillating agitator and in the steam hood. The agitator consists of six stirring portions, three of which located on the up side are of the ordinary type, while the three located on the down side of the trough are of hollow cast iron with perforations from which fresh brine may be circulated to assist in keeping the salt in suspension. The hood is constructed of sheet metal and covers about one-third of the circumference of the drum. The first few inches of the hood on the up side consist of a chamber in which live steam comes in contact with the salt cake. Beyond a member which separates this section of the hood from the rest, the salt, heated by the steam, is subjected to an atmosphere of air at a temperature of about 170 deg. C. The air, as is the steam, is drawn through the cake by suction which is maintained on the filter section. The air is heated by passing down between steam coils located in the super-structure above the hood. The salt is thus dried to such an extent that it is rarely necessary to blow the cake with air to effect a discharge.

The capacity of the new filter depends upon the moisture content demanded in the discharged salt. This moisture content may range from 1¾ to 3½ per cent with a production of two to four tons of salt per sq.ft. of filtering surface per 24 hours. Power requirements, including filter, vacuum exhauster, brine filtrate pump and steam, total 0.10 to 0.25 hp. per ton of salt handled per 24 hours. Labor amounts to 0.016 to 0.05 man-hr. for the same unit. These requirements, which are considerably less than those for centrifuge operation, coupled with the simplicity and small attendance required by the Oliver filter, show a marked saving in favor of this method of salt dewatering. The only labor necessary is supplied by the pan crew.

The filter may be supplied in sizes 4x2 ft., 4x4 ft., and 4x6 ft. There is also a special model 6 ft. in diameter by 4 ft. A small filter 2½x1 ft. completes the line. The material used is normally cast iron, but this may be altered in special cases. While the principal use for the filter at present is the removal of sodium chloride from brine, other salts such as sulphates and certain double salts are being successfully handled. Modifications in design are constantly being made to handle other crystalline products which differ considerably from vacuum pan salt.

Vertical Grinder

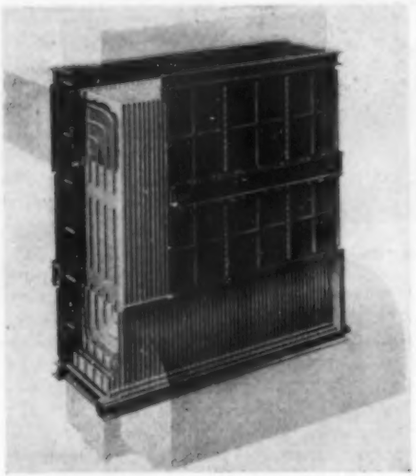
A new product of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., is a novel style of compact, vertical grinder, comprising an attrition mill and a vertical squirrel cage motor built into a unit. The new grinder while supplied in various sizes with motors ranging from 25 to 50 hp. and capacities per hour varying from 2,000 to 10,000 lb., is in all of its models the same external size and is approximately as large as a barrel.

The grinder consists of a casing in the lower part of which is mounted the motor and above the motor and separated from it by a dust-tight partition are the two grinding elements of the attrition mill. One element is attached to the casing while the other rotates with the motor. The material is fed into the center of the rotating element and is thrown out by centrifugal force, passing between the teeth of the grinding portion. An external adjustment with a quick throwout and a relief spring to permit separation of the grinding ele-

ments should a hard object enter the mill enables the operator quickly to adjust the fineness of grinding. The new mill is intended primarily for comparatively soft or fibrous materials. Drugs, grains, herbs and various fine chemicals are among the materials ground.

Air Preheater

A number of changes, designed to increase the effectiveness of the C-E plate type air preheater have been announced by the Combustion Engineering Corporation, 200 Madison Avenue, New York City. The heater, shown in the illustration herewith, now embodies one or more clean-out doors in the heater casing to permit blowing the entire surfaces of the gas passages with steam or air lances. The heater may be



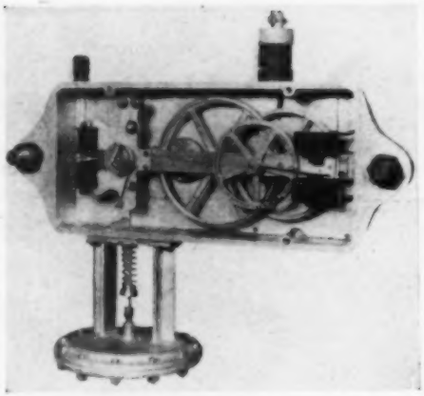
C-E Air Preheater

cleaned while the unit is in operation. A further improvement consists in the use of welding to prevent leakage between the air and gas sides of the preheater. The construction also reduces the amount of erection work necessary. To further improve the transfer of heat, the "S" type of design is now used whenever possible.

Electric Heating System Control

Industrial heating systems are now frequently sectionalized to take advantage of the varying amounts of heat required in different parts of buildings. This is frequently accomplished by placing a throttle valve in the supply mains to each section. Webster Talmadge & Company, Inc., 50 Church Street, New York City, has developed an electric control, which is shown in part herewith, for centralized operation of these remotely controlled valves.

Located in the chief engineer's office is a control panel with signaling mechanism for the regulation of each heating section throughout the plant or building. When it is desired to supply, perhaps, only 30 per cent of the normal steam supply to one section, a dial is



Remotely Controlled Mechanism for Setting Pressure Regulating Valves

turned to 30. A series of electric impulses are automatically sent to the proper controller, energizing one or the other of the two magnets shown at the extreme left. Through a pawl and ratchet wheel operated by the magnet armature, the impulses adjust a cam adjacent to the magnet so as to take a definite position for each position of the control knob mentioned above. A cam follower riding on the cam controls the forward and reverse switches for a motor mounted behind the controller (not shown), which motor opens or closes the controlling valve. At the same time, a diaphragm shown below the controller and connected with the low pressure side of the valve, cooperates with the cam to actuate the cam follower and the motor switch. The result is that for any setting of the apparatus the diaphragm will maintain the proper reduced pressure on the line.

The large gearing shown at the right operates a limit switch for the protection of the motor which drives the valve. This device, together with its centralized control, makes possible a saving in steam, frequently as great as 25 to 50 per cent, the makers claim.

Bitumen Gun

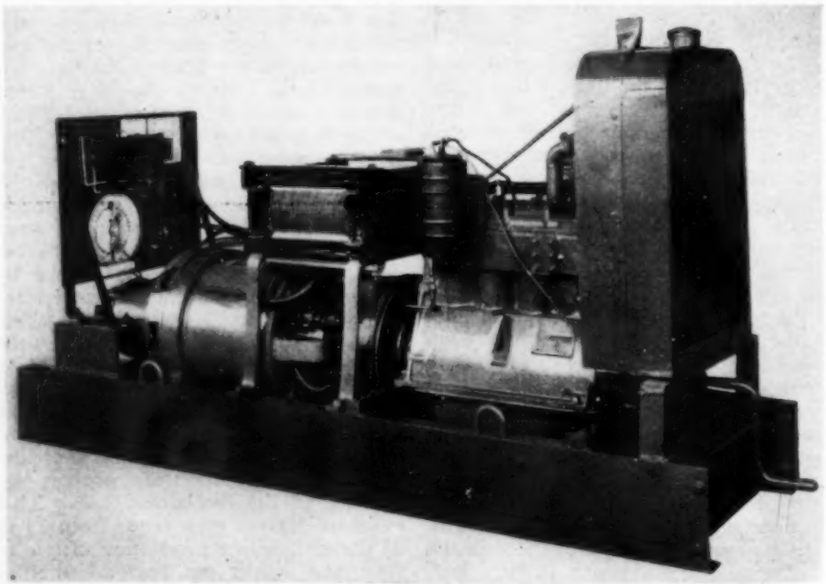
A modification of the refractory gun manufactured by the Quigley Furnace Specialties Co., 26 Cortlandt St., New York City, has resulted in the development of a new bitumen gun for spraying such materials as asphalt, pitch and tar. The apparatus consists of the gun proper, a cylinder from which the hot bitumen may be forced by air pressure acting upon a piston, and a steel housing for the gun mechanism mounted on wheels. A small kerosene burner mounted within the housing permits heating of the bitumen. Air at 60 lb. pressure is used to force the gun charge of 15 gal. through an insulated metallic hose which may be as long as several hundred ft. It is said that 15 gal. of bitumen will cover about 400 sq.ft. of surface.

The new gun is recommended for use in waterproofing foundations and walls as well as coating the interior of tanks, vats and reservoirs. It may also be used for applying protective coatings to pipe lines and to all exposed metallic surfaces. Two men are required to operate the gun, and can, it is claimed, work about six times as fast as by the hand method.

Portable Arc Welder

The Lincoln Electric Co., Cleveland, Ohio, has announced a new "stable-arc" welder, known as model S-1960. This is a self-contained, light-weight, readily portable arc welder which supplies its own motive power.

The new unit has a N.E.M.A. rating of 200 amp., with a current range for welding duty of from 50 to 300 amp., and operates at a speed of 1,500 r.p.m. Motive power is provided by a 4-cylinder Continental Red Seal engine, type H-9. Generator and engine are mounted on a welded structural steel base which provides stiffness and rigidity with min-



Portable Stable Arc Welder

imum weight. The unit weighs 1,580 lb. and is 76 in. long by 25 in. wide.

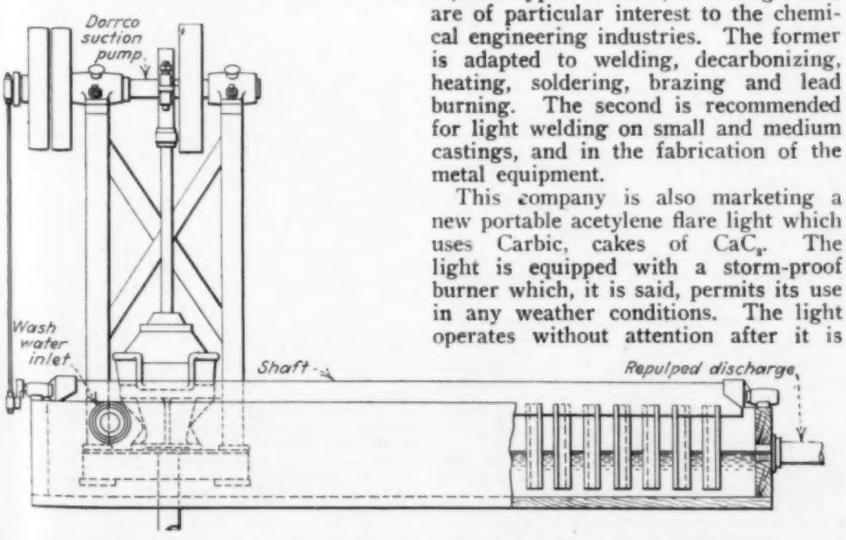
The generator is of welded steel construction, as is also the switchboard. The unit is not designed to replace this company's present heavy-duty, engine-driven equipment, but is intended to provide a portable welder for lighter service.

Repulping Launder

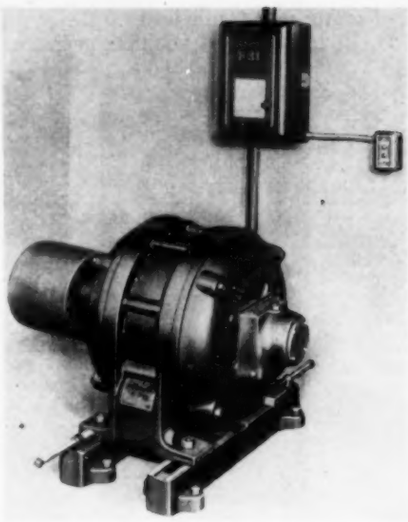
The Dorr Company, 247 Park Ave., New York, have introduced a new accessory known as the Dorrco Repulper for use in connection with thickeners in continuous counter current decantation installations. This device, as is shown on the accompanying cut, is a mechanical mixing unit, installed in the launders between adjacent thickeners, for effecting a more intimate mixing of the solids and the wash water than is afforded by simple gravity flow in an inclined, baffled launder.

On the top of a launder of rectangular cross section, extending from the diaphragm pump of one thickener to the feedwell of the next thickener, there is mounted on bearings a shaft which extends in the same direction as the trough and parallel with it. From this shaft a series of vertical paddles are suspended, the lower ends of which are immersed in the pulp in the launder. An eccentric on the end of the diaphragm pump shaft, oscillates the repulper shaft through a crank and adjustable connecting rod.

The paddles are staggered and set at an angle so that, in addition to mixing the sludge with the wash water, they convey the pulp mechanically to the discharge end of the repulper. The features which are said to make this device especially adapted to counter current decantation plants are the prevention of the segregation of solids in the launders, more effective washing of the sludge and the completion of all leaching or dissolving before the pulp enters the next thickener. The difference in elevation of adjacent thickener tanks need not be great, since the pulp conveying feature makes steep launder slopes unnecessary.



Repulper or Mixing and Conveying Launder for Use Between Thickeners



Line Start Induction Motor

Line Start Induction Motors

A series of squirrel-cage induction motors suitable for starting on full-line voltage has been placed upon the market by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis. These motors are normal torque, high reactance machines, and will not draw, it is said, starting current in excess of the limit recommended by the N.E.L.A. The motors are produced either with sleeve or anti-friction bearings, and require only a magnetic switch with push button control for starting equipment. They are built in ratings from 7½ to 30 hp., and from 600 to 3,600 r.p.m.

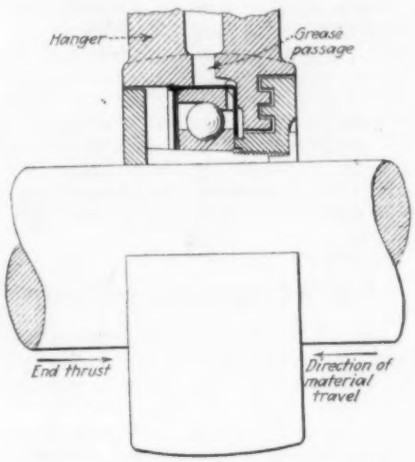
Acetylene Equipment

The Oxweld Acetylene Co., 30 East 42d St., New York, N. Y., has placed upon the market three new Prest-O-Weld welding outfits, of which two, Type W-102-A, a general purpose outfit, and Type W-102-B, a welding outfit, are of particular interest to the chemical engineering industries. The former is adapted to welding, decarbonizing, heating, soldering, brazing and lead burning. The second is recommended for light welding on small and medium castings, and in the fabrication of the metal equipment.

This company is also marketing a new portable acetylene flare light which uses Carbic, cakes of CaC_2. The light is equipped with a storm-proof burner which, it is said, permits its use in any weather conditions. The light operates without attention after it is charged and may be easily recharged when the carbide is exhausted. The light is available in sizes ranging from a hand model to an 8,000 candle power burner. A double burner model is also provided which supplies illumination in two directions simultaneously.

Dust-Proof Conveyor Bearing

The Transmission Ball Bearing Company, 1050 Military Road Buffalo, N. Y., has recently begun production on the Chapman dustproof ball bearing and hanger which are illustrated in the accompanying cut. This equipment is designed primarily for use in spiral conveyors which are engaged in carrying dusty or abrasive materials. The bearing is fully enclosed and is protected by a labyrinth cap which fits on the material-handling end of the bearing over a threaded portion of the adaptor sleeve. The ball races are entirely enclosed in



Labyrinth-Protected Spiral Conveyor Bearing

a steel cap with a steel spring end-piece at one side which maintains close contact with the ends of the races. Lubricant is introduced into the bearing through a pressure type grease fitting and a passage drilled in the hanger. The hanger, made as an integral part of the bearing support, eliminates the necessity for U-bolts and simplifies installation. The design is such that the bearing is also said to be suitable for conveying hot materials, in that expansion and contraction are provided for. Complete units are being built in sizes to fit the standard conveyors on the market.

Rubber Covered Extension Lamp

A new extension lamp manufactured by the Daniel Woodhead Co., Chicago, Ill., is provided with a rubber socket and handle, so that shocks due to dropping or otherwise mishandling the lamp will not break either glass or filament. This feature adds considerably to the safety of such a lamp about the chemi-

cal plant, as fire hazard is materially reduced. The device is known as the Protex extension lamp. A modification of this lamp produced by the same company utilizes a vapor-proof globe in connection with the flexible rubber handle, thus adding an additional degree of safety to the use of the lamp in plants where there is a possibility of an explosion hazard.

Metallic Sealing Compound for Pipe Threads

Merco compound, a product of the Alloys Co., San Francisco, Calif., is a new metallic lead sealing material for use on pipe threads and gaskets. It consists of fine metallic lead suspended in a vehicle which is insoluble in oil, gasoline, gas and solvents. Heat, it is said, causes the vehicle to carbonize and increases its volume, thus improving the seal.

Since metallic lead is malleable, the compound flows into the voids in the joints, and yet permits the joints to be broken readily. While the manufacturers state that this material is for use where difficult conditions are encountered, it is not recommended for use on faulty threads, although excellent results are said to be obtained in using second-hand pipe when the threads are in good condition.

Motor-Connected Pump

The M. L. Oberdorfer Brass Company, Syracuse, N. Y., has announced the addition of a new motor-connected centrifugal pump as a final member of a line of small pumps. The new pump is constructed of a corrosion resistant alloy and is adapted to handle 2,100 gal. per hour at no load. It is capable of pumping against a 24-ft. head using a ½-hp., 1,725-r.p.m. motor. It is intended for such uses as sump pumping, unloading tank cars and for handling light oils, gasoline, fuel oil and similar liquids in moderately large volume.

CO_2 and Draft Recorder

Announcement is made by the Hays Corporation, Michigan City, Ind., of a new automatic CO_2 and draft recorder which is guaranteed to be accurate within one-half of 1 per cent of CO_2 in any range of the chart. The instrument consists of an automatic Orsat apparatus which is said to be very simple, to require practically no attention and to have a very small lag. Corrections for varying gas temperatures and pressure are made automatically in cooling and measuring the gas.

The illustration reproduced herewith shows a front view of the recorder panel. CO_2 analysis is recorded around the outside of the chart while the center section shows inches of water of furnace draft. In effect, the recorder withdraws a sample of gas, adjusts this to standard temperature and pressure, absorbs the CO_2 in caustic soda solution, measures

Hays Model B CO_2 and Draft Recorder

the reduction in volume of the gas and records the result periodically as per cent of CO_2.

Erratum.—In the April, 1928, issue of *Chem. & Met.* it was stated in connection with an article describing the new 400-mesh wire cloth made by the Newark Wire Cloth Company that this material could be produced in a variety of metals ranging from steel to platinum and gold. As this is incorrect and phosphor bronze is the only material in which the 400-mesh cloth is produced, occasion is now taken to correct the error.

Manufacturers' Latest Publications

Oster Mfg. Company, Cleveland, Ohio.—Catalog No. 36—Tools and machinery for pipe-fitting.

Air Conditioning & Engineering Company, 2914 S. Jefferson Ave., St. Louis, Mo.—Bulletin describing the "Electrozone" self-controlled water sterilizer.

Crouse Hinds Company, Syracuse, N. Y.—Publications as follows: Catalog No. 310, "Floodlights and Industrial Lighting Units," contains illuminating data and describes all types of floodlights and industrial lighting units. Bulletin 2112, "Railway Mail Car Lighting and Fan Installations."

The American Rolling Mill Company, Middletown, Ohio.—"The Development and Service of Armco Ingot Iron." A 48-page booklet is devoted to the discussion of the development of Armco iron, some of the outstanding installations of this material, views of the principal Armco plants and a picture trip through the East Works at Middletown.

Steacy-Schmidt Manufacturing Company, York, Pa.—Bulletin As 122—Special machinery made by this company.

The Hardinge Company, York, Pa.—Bulletin Ah 119 and Ah 120—Concerning Ruggles-Coles Driers, Hardinge conical mills and Hardinge thickeners and clarifiers.

The Brown Instrument Company, Philadelphia, Pa.—A folder concerning Brown recording instruments.

The Foxboro Company, Foxboro, Mass.—Bulletin DMF-528 — Foxboro indicating thermometers.

The Bristol Company, Waterbury, Conn.—Catalog 1800—Complete catalog concerning recording liquid level gages.

Yarnall-Waring Company, Chestnut Hill, Philadelphia, Pa. — 1927 installations of Yarway high-pressure blowoff valves.

Palmer-Bee Company, Detroit, Mich.—Catalog No. 48—Describes herringbone and spur gear speed reducers, flexible couplings; gives engineering data.

De Laval Steam Turbine Company, Trenton, N. J.—Bulletin E-1118—"De Laval Pumps at Palm Beach and West Palm Beach," an article by Malcolm Pirnie.

Dust Recovering and Conveying Company, Harvard Avenue & 113th Street, Cleveland, Ohio—Bulletin No. 3 revised—A reprint from *Chem. & Met.* on "Dust Menaces in Industrial Plants" by D. J. Price.

Monitor Controller Company, Baltimore, Md.—Bulletin No. 110—"Speeding Up Production with Automatic Control," applications of the Monitor control. Bulletin No. 112—"Thermaload Starters."

Rusticide Co., Cleveland, Ohio—Folder describing "Rust-i-cide" a material for chemically removing rust from metal surfaces.

Irving Iron Works Company, Long Island City, N. Y.—Folder F-130—Describes Irving continuous floor armoring for use with concrete, mastic or other plastic floor materials.

The Leavitt Machine Company, Orange, Mass.—Bulletin No. 28—Describes the new Dexter tank car outlet valve reseating machine.

The General Electric Company, Schenectady, N. Y. — Publications as follows: GEA-233-B, centrifugal air compressors, single stage; GEA-308-A, arc suppressor plates; GEA-359-A ornamental Novalux; GEA-498-A, circular coils; GEA-584-A, totalizing recording instruments, and remote indicators; GEA-752, direct-current motors, type BD; GEA-835-A, D.C. magnetic controllers; GEA-884, electric equipment for window-glass plants; GEA-894, adjustable speed D.C. motors, type C.D.; GEA-934, automatic throw-over panels; GEA-948, D.C. magnetic controllers; GEA-950, inclosed starting rheostats; GEA-966, indoor metal-clad switching equipment.

Semet-Solvay Engineering Corporation, 40 Rector Street, New York City.—Bulletins Nos. 338, 339, 340 and 341—RS deemulsifiers, Steere water gas machines, Steere water sprays and Semet-Solvay repeat orders.

Combustion Engineering Corporation, 200 Madison Ave., New York, N. Y.—Catalog AH-3—Describes the improved form of C-E air preheater, with data on typical installations. Also a reprint of an article entitled "Fisher Body Corporation burns sawdust and coal and flint."

The Savogran Company, Boston, Mass.—"The superintendent's exchange, Volume 2," practical hints for users of paints.

R. P. Cargille, 26 Cortlandt St., New York, N. Y.—Circular A—Products for testing paints, varnishes, lacquers and colors.

Ingersoll-Rand Company, 11 Broadway, New York, N. Y.—"One Hundred and One Ways to Save Money with Portable Compressors," sixth edition, revised. Describes portable compressors and many uses for these machines in connection with pneumatic tools, 100 pages.

The International Nickel Company, 67 Wall Street, New York, N. Y.—"Improved Machinability" of nickel iron castings.

Chicago Pneumatic Tool Company, New York, N. Y. — Catalog No. 561 — Covers pneumatic tools and accessories, 70 pages.

Crescent Refractories Company, Curvensville, Pa.—Bulletin No. 19—"An Elementary Account of Chemical Analysis of Refractory Materials."

The D. O. James Manufacturing Company, 1120 West Monroe St., Chicago, Ill.—Folder concerning James speed reducers.

General Refractories Company, 106 South Sixteenth Street, Philadelphia, Pa.—Publications as follows: "7 Arcofrax Linings"; also "Choosing a High Temperature Cement."

The J. H. Day Company, Cincinnati, Ohio—Bulletin KK—"Mogul" Experimenting Kneading and Mixing Machines with interchangeable agitators.

The Clarage Fan Company, Kalamazoo, Mich.—Catalog No. 74—Dealing with Clarage Unit Humidifiers.

Prat-Daniel Corporation, 101 Park Ave., New York, N. Y.—Reprint on "Thermix" Type 4 stacks for removing dust, cinders and fly-ash.

Bayley Blower Company, Milwaukee, Wis.—Folder describing the new "Chinook-fin" Unit Heaters.

Hills-McCanna Company, Chicago, Ill.—Bulletin covering Hills-McCanna proportioning pumps.

Century Electric Company, St. Louis, Mo.—Form 663—Describes this company's type D.M. direct current motors.

The Globar Corporation, Niagara Falls, N. Y.—Bulletin D—Dimensioned details of standard furnace type Globar terminal mountings and parts used in electric furnaces heated by Globar elements. Also curves giving engineering data on temperature characteristics of Globar elements.

PATENTS ISSUED
Apr. 3 to May 1, 1928

PAPER, PULP AND SUGAR

Cylinder Paper-Making Machine. Arthur T. Yoder, Mosinee, Wis.—1,664,722.

Centrifugal Pulp Screen. George F. Shevlin, Glens Falls, N. Y., assignor to George F. Shevlin & Son, Glens Falls, N. Y. —1,664,996.

Paper-Making Machine. Christian Seybold, Duren, and Josef Boltersdorf, Kreuzau, near Duren, Germany.—1,666,472.

Process for Obtaining Tricalcium Saccharate. Carl Steffen, Jr., Vienna, Austria. —1,667,446. *From filter cake.*

Recording Device for Paper Machines. Charles J. Guenther, Boston, Mass., assignor to Stickle Steam Specialties Company, Indianapolis, Ind.—1,667,516. *Controlling heat.*

Apparatus for Producing and Feeding Paper Pulp. Ralph Swan Clarke, Walpole, Mass., assignor to Bird Machine Company. —1,668,141.

Method of Making Dextrose. Charles Ebert, Leonia, N. J.; William B. Newkirk, Riverside, Ill.; and Meyer Moskowitz, Spring Valley, N. Y., assignors to International Patents Development Company, Wilmington, Del.—1,668,308.

Paper Backing and Process of Coating the Same. Gerhardt E. Grimm, Springfield, Mass., assignor to Westfield River Paper Company, Russell, Mass.—1,667,853.

RUBBER, RAYON AND SYNTHETIC PLASTICS

Amylaceous Molded Product and Process of Making Same. Carleton Ellis, Montclair, N. J., assignor to Ellis-Foster Company.— 1,664,600.

Cassava-Starch Plastic Composition and Method of Molding Same. Carleton Ellis, Montclair, N. J., assignor to Ellis-Foster Company.—1,664,601.

Film-Treating Apparatus. John G. Capstaff, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.— 1,664,735. *Motion picture film.*

Process of Making Sulphur-Containing Plastics. Carleton Ellis, Montclair, N. J., assignor to Ellis-Foster Company.—1,665,-186.

Process for Making Furfural Resins. John P. Trickey, Evanston, and Carl S. Miner, Chicago, Ill., assignors to The Quaker Oats Company, Chicago, Ill.— 1,665,233.

Furfuralcohol Resins. John P. Trickey, Evanston, and Carl S. Miner, Chicago, Ill., assignors to The Quaker Oats Company, Chicago, Ill.—1,665,235.

Process for Obtaining Furane Derivatives. John P. Trickey, Evanston, and Carl S. Miner, Chicago, Ill., assignors to The Quaker Oats Company, Chicago, Ill.— 1,665,236.

Compound Resinous Substance and Process of Making Same. John P. Trickey, Evanston, and Carl S. Miner, Chicago, Ill., assignors to The Quaker Oats Company, Chicago, Ill.—1,665,237. *Furnace derivative.*

Process of Producing Artificial-Silk Filaments by Drawing. Kurt Grunert, Turin, Italy—1,665,453. *Cuprammonium.*

Production of Artificial Silk. Walter Hamis, Glover, Leamington, and Charles Fred Topham, Coventry, England, assignors to Courtaulds Limited, London, England.— 1,665,958.

Permanent Finish Vegetable Material and Process of Producing Same. Albert Bodmer, Wattwil, Switzerland, assignor to Heberlein Patent Corporation, New York, N. Y.—1,666,082.

Vegetable Yarn and Fabric With Woollike Effects. Albert Bodmer, Wattwil, Switzerland, assignor to Heberlein Patent Corporation, New York, N. Y.—1,666,083.

Synthetic Resin. Charles E. Burke and Horace H. Hopkins, Wilmington, Del., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del. — 1,667,189. *From pentaerythrite.*

Water-Resistant Polyhydric Alcohol-Carboxylic-Acid Resin and Process of Making Same. Charles R. Downs, Cliffside, and Louis Weisberg, Grantwood, N. J., assignors to The Barrett Company.—1,667,-197.

Enamel for Coating Cans. Roger H. Lueck, Oak Park, Ill., assignor, by mesne assignments, to the Public of the United States of America.—1,667,212. *Oleoresin varnish.*

Process for Dyeing Artificial Silk. James Baddiley, Percy Chorley, and Carlton Butler, Manchester, England, assignors to British Dyestuffs Corporation Limited, Manchester, England.—1,667,524.

Accelerator for Hardening Phenol Urea Products. Howard Vincent Potter and John Willies Crump, Birmingham, England, assignors to The Damard Lacquer Company Limited, London, England.—1,667,675.

Rubber Composition and Method of Producing the Same. Harry L. Fisher, Leonia, N. J., assignor to The B. F. Goodrich Company, New York, N. Y., a Corporation of New York.—1,668,235-7.

Plastic Material and Process of Making the Same. Edward L. Aiken, East Orange, N. J., assignor to Carboloid Products Corporation, Newark, N. J.—1,668,444.

Method of Making Flexible Molded Articles of Condensation Products. Edward L. Aiken, East Orange, N. J., assignor to Carboloid Products Corporation, Newark, N. J.—1,668,445.

Esterification of Cellulose. Henri Louis Barthélemy, Vercelli, Italy, assignor to Ruth Aldo Company, Inc., New York, N. Y. —1,668,484.

Rubber-Sheet Material for Manufacturing. Gerhardt E. Grimm, Springfield, Mass., assignor to Westfield River Paper Company, Russell, Mass.—1,667,854.

Butyl Aldehyde-Phenol Resins and Process of Making the Same. Conrad F. Schrimpe, Perth Amboy, N. J., assignor to Bakelite Corporation, New York, N. Y.— 1,667,872.

PETROLEUM REFINING AND PRODUCTS

Art of Distilling Lubricating Oils. Richard W. Hanna, Piedmont, Calif., assignor, by mesne assignments, to Standard Oil Company of California, San Francisco, Calif.—1,664,977.

Producing Stable Emulsions. Robert Mezger, Stuttgart, Germany.—1,665,105.

Neutralizing Treatment of Acid Oils for Lubricant Stocks. George F. Olsen, Los Angeles, Calif., assignor to General Petroleum Corporation of California.—1,665,110.

Separation of Acid-Sludge Emulsions. Ernest W. Roth, Los Angeles, Calif., assignor to General Petroleum Corporation of California, Los Angeles, Calif.—1,665,189.

Process for the Production of Unsintered Binding Means of Oil Shale and Limestone and the Like. Oscar Tetens, Oerlinghausen Lippe, Germany.—1,665,993.

Apparatus for and Process of Distilling Oils. Charles B. Buerger, Pittsburgh, Pa., assignor to Gulf Refining Company, Pittsburgh, Pa.—1,666,042.

Process of Distilling Hydrocarbon Oils. William P. Deppé, Brightwaters, and Leland L. Summers, New York, N. Y.; Llewelyn L. B. Summers and Arthur Young administrators of said Leland L. Summers, deceased.—1,666,051.

Process and Apparatus for Separating Gasoline from Crude Oil. Arthur E. Pew, Jr., Bryn Mawr, and Henry Thomas, Ridley Park, Pa., assignors to Sun Oil Company, Philadelphia, Pa.—1,666,300.

Process and Apparatus for Distilling Mineral Oil. Arthur E. Pew, Jr., Bryn Mawr, and Henry Thomas, Ridley Park, Pa., assignors to Sun Oil Company, Philadelphia, Pa.—1,666,301.

Process and Apparatus for Distilling Mineral Oil. Arthur E. Pew, Jr., Bryn Mawr, and Henry Thomas, Ridley Park, Pa., assignors to Sun Oil Company, Philadelphia, Pa.—1,666,302.

Apparatus for Extracting Oil from Shale. Richard Crawshaw, Drumright, Okla.— 1,666,488.

Method of Refining Heavy Mineral Oils by Means of Sulphur Dioxide in a Continuous Operation. Lazar Edeleanu, Karl Pfeiffer, Karl Gress, and Paul Jodeck, Berlin, Germany.—1,666,560.

Process for Distilling Oils. Audley E. Harnsberger, Columbus, Ohio, assignor to The Pure Oil Company, Chicago, Ill.— 1,666,597.

Gas-Absorption Apparatus. Wilbur G. Laird, New York, N. Y., assignor to Henry L. Doherty, New York, N. Y.—1,666,744.

Method of and Apparatus for Evaporating and Distilling. John S. Forbes, Philadelphia, Pa.—1,666,777.

Gasoline Substitute and Process of Making. John B. Neuendorff, San Antonio, Tex. Substitute for application Serial No. 473,382.—1,666,976.

Apparatus for Mixing Sludge. Robert Beattie, Fort Worth, Tex., assignor to Texas Pacific Coal and Oil Company, Fort Worth, Tex.—1,667,235.

Oil-Mining Method and Apparatus. Leo Ranney, New York, N. Y., assignor to Standard Oil Development Corporation.— 1,667,269.

Process of Fractionating Oils. Clive M. Alexander, Tulsa, Okla.—1,667,340.

Method of Oxidizing Mineral Hydrocarbons. Joseph Hidy James, Pittsburgh, Pa. —1,667,419.

Motor Fuel. Thomas Midgley, Jr., Dayton, Ohio, assignor, by mesne assignments to General Motors Corporation, Detroit, Mich.—1,668,022.

Apparatus for Treating and Combining Hydrocarbon Liquids and Gases and Other Liquids and Gases. Nicholas H. Colwell, New York, N. Y.—1,668,104.

Removal of Sulphur and Sulphur Compounds from Hydrocarbon Oil. Gerald L. Wendt, Chicago, Ill., assignor to Standard Oil Company, Whiting, Ind.—1,668,225.

Treatment of Hydrocarbons. Wilhelm Hess, Berlin, Germany.—1,668,275. *With sulfur dioxide.*

Process for Treating Hydrocarbon Oils. Walter M. Cross, Kansas City, Mo., assignor to The Gasoline Products Company, New York, N. Y.—1,667,883.

COAL PROCESSING AND COMBUSTION

Apparatus for Absorbing Fluids from Gases. Emil Piron, New York, N. Y., assignor to Piron Coal Distillation Systems, Inc., New York.—1,664,483.

Method of Removing Tar from Gases. Emil Piron, New York, N. Y., assignor to Piron Coal Distillation Systems, Inc., New York, N. Y.—1,664,484.

Coking Retort Oven. Heinrich Koppers, Essen-Ruhr, Germany, assignor to The Koppers Development Corporation, Pittsburgh, Pa.—1,664,632.

Coking Retort Oven. Nathaniel G. Parry, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,664,633.

Cooking Retort Oven. Joseph Van Ackeren, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,664,-649.

Degasification of Coal. Niels Young, Frankfort-on-the-Main, Germany. — 1,664,-723.

Still. Franz Puening, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,664,863. *For tar.*

Process for Producing a Hard Low-Temperature Coke. Kurt Jahnke, Ludwigsburg, Germany.—1,665,665.

Fuel Material. Theodore Nagel, Brooklyn, N. Y.—1,666,663.

Method of Obtaining Valuable Products from Combustible Materials. Adam Helmer Pehrson, Stockholm, Sweden, assignor to Dunford & Elliott (Sheffield) Limited, Sheffield, England.—1,667,217.

Process for the Production of Gas. Harold Hardy Smith, Johannesburg, South Africa, assignor to Minerals Separation North American Corporation, New York, N. Y.—1,667,272.

Treatment of Fine Coal. Eltoft Wray Wilkinson, Queens Village, N. Y., assignor to Minerals Separation North American Corporation, New York, N. Y.—1,667,277.

Manufacture of Fuel Briquettes. Ernest Windsor Bowen, London, England.—1,667,-304.

Fuel Briquette and Method of Making Same. Jacob Shotwell Robeson, Pennington, N. J.—1,667,358.

Process of Making Carbureted Water Gas. Fred B. Hayes, Fort Wayne, Ind., assignor to Western Gas Construction Company, Fort Wayne, Ind.—1,667,518.

Distilling Apparatus for Carbonaceous Fuel. Walter Edwin Trent, Washington, D. C., assignor to Trent Process Corporation, New York, N. Y.—1,668,131.

Manufacture of Carbonized Fuel. Walter William Strafford, Hampton-on-Thames, England, assignor to The Fuelite Company Limited, Grays Inn, London, England.—1,667,906.

Organic Processes

Preparation of Metal Halides. John Wesley Marden, East Orange, N. J., assignor to Westinghouse Lamp Company.—1,665,634.

Process of Manufacturing Formic Acid. Guy H. Buchanan, Westfield, and John L. Osborne, Elizabeth, N. J., assignors to American Cyanamid Company, New York, N. Y.—1,666,437.

Process for the Oxidation of Alcohol. Stefan Goldschmidt, Karlsruhe, Germany.—1,666,447.

Manufacture of Paraformaldehyde. Ernst Kuss, Mannheim, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany. — 1,666,708.

Gelatin-Dynamite Explosive. Roscoe B. Smith, Kenvil, N. J., and Ernest M. Symmes, Wilmington, Del., assignors to Hercules Powder Company, Wilmington, Del.—1,667,083.

Condensation Product from Olefines and Hydrocarbons of the Naphthalene Series and Process of Making the Same. Richard Michel, Uerdingen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,667,214.

Manufacture of New Sulphonic Derivatives of Unsaturated Fatty Acids. Alfred Thauss, Cologne-Deutz, Gustav Mauthe, Cologne-Muhlheim, and Alfred Günther, Cologne-Riehl, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,667,225.

Process for the Preparation of Sulphonic Acids of Aralkylated Unsaturated Fatty Acids. Alfred Thauss, Cologne-Deutz, Gustav Mauthe, Cologne-Muhlheim, and Alfred Günther, Cologne-Riehl, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,667,226.

Process for the Preparation of Organic Arsenic Compounds. Arthur Binz, Berlin, and Curt Räth, Rangsdorf, Germany.—1,667,237.

Alkyl Derivatives of Diphenolisatine and Process for Making Same. André Blankart, Basel, Switzerland, assignor to The Hoffmann-La Roche Chemical Works, New York, N. Y., a Corporation of New York.—1,667,239.

Azodyestuffs and Process of Making Same. Hermann Fritzsche, Eduard Krummenacher, Hans Gubler, and Otto Kaiser, Basel, Switzerland, assignors to Society of Chemical Industry in Basel, Basel, Switzerland.—1,667,312.

Method for the Reduction of Arsonic Acids. Arthur Binz, Berlin and Curt Räth, Rangsdorf, Germany.—1,667,238.

Dyestuffs and Process of Making Same. Fritz Straub, Basel, and Hermann Schneider, Riehen, near Basel, Switzerland, assignors to the Firm Society of Chemical Industry in Basel, Basel, Switzerland.—1,667,333.

Alkali Fusion. Vaman R. Kokatnur, New York, N. Y.—1,667,480.

Continuous Process for the Dehydration of Volatile Fatty Acids. Eloi Ricard, Melle, France, assignor to Société Anonyme des Distilleries des Deux-Sevres, Melle, France.—1,668,380.

Azodyestuffs and Process of Making Same. August Leopold Laska and Arthur Zitscher, Offenbach-on-the-Main, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort, Germany.—1,667,667.

Process of Purifying Phosphatides Obtained from Oilseeds and the Like. Hermann Bollmann, Hamburg, Germany, assignor, by mesne assignments, to Mary Fulford Foster, trustee, Washington, D. C.—1,667,767.

Inorganic Processes

Production of Helium from Natural Gas. Pierre E. Haynes, Buffalo, N. Y., assignor to The Linde Air Products Company.—1,664,412.

Process for the production of Magnesium Oxide. William Koehler, Cleveland, Ohio.—1,664,630.

Plaster-Block Composition. Frederick M. Venzie, Philadelphia, Pa.—1,667,019.

Process for the Production of Refractory Magnesia Compounds. William Koehler, Cleveland, Ohio.—1,664,631.

Zinc Oxide. Frank G. Breyer, Earl H. Bunce, and John H. Weikel, Palmerton, Pa., assignors to The New Jersey Zinc Company, New York, N. Y.—1,664,767. *Reducing acidity.*

Process of Drying Gases. Roland Edgar Slade, Billingham-on-Tees, and Victor Emmanuel Parke, Runcorn, England, assignors to Atmospheric Nitrogen Corporation, Solvay, N. Y.—1,664,997.

Process for the Production of Artificial Stone and Artificial Wood. Franz Trachsel and Jakob Wiedmer, Bern, and Paul Zigerli, Zurich, Switzerland.—1,665,148.

Manufacture of Catalysts. Harald Nielsen, Muswell Hill, London, England, assignor of one-half to Bryan Laing, Hatfield, England.—1,665,175. *For formic acid.*

Silica Gels and Process of Making the Same. Harry N. Holmes and John A. Anderson, Oberlin, Ohio.—1,665,264.

Method of Recovering Aluminum Chloride from Sludge. Paul Danckwardt, La Junta, Colo.—1,665,406.

Dispersing Powder and Process of Making. Edward R. Allen and Wilford E. Kaufmann, East Orange, N. J., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,665,945. *For pigments.*

Light-Weight Gypsum Products. Carlisle K. Roos and Murrell G. Allison, Fort Dodge, Iowa, assignors to United States Gypsum Company, Chicago, Ill.—1,666,180. *Addition of sodium silicate.*

Copies of Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Photostatic copies of foreign patents may be obtained at the same address, prices on application.

Producing Mixtures of Nitrogen and Hydrogen. Wilhelm Gaus and Wilhelm Wild. Ludwigshafen-on-the-Rhine. Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,666,694.

Process for Utilization of Lignin. Robert Griessbach and Julius Eisele, Ludwigshafen-on-the-Rhine, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany. — 1,666,696.

Process of Washing Salts. George B. Burnham, Reno, Nev., assignor to Burnham Chemical Company, Reno, Nev.—1,666,733.

Glue and Process of Making Same. Paul Kreismann, Chicago, Ill.—1,667,073.

Ammonia Synthesis Process and Catalyst. Alfred T. Larson, Wilmington, Del., assignor to Lazote, Incorporated, Wilmington, Del.—1,667,322-3.

Process for Obtaining Alkaline-Earth-Metal Sulphides from Alkaline-Earth-Metal Sulphates. Theodor Lichtenberger, Heilbronn, and Konrad Flor, Buckeburg, Germany.—1,667,423.

Process for Making Calcium Arsenate. William C. Piver, Hillside, N. J.—1,667,490.

Method of Making Copperas. Henry Carlisle Stewart, Philadelphia, Pa., assignor to the Westmoreland Chemical & Color Company, Philadelphia, Pa.—1,667,693.

Art of Phosphoric Acid Manufacture. Ingenuin Hechenbleikner, Charlotte, N. C., assignor to Chemical Construction Company, New York, N. Y.—1,667,549.

Conversion of Lead Sludge. Joseph Bennett Hill, Philadelphia, Pa., assignor to the Atlantic Refining Company, Philadelphia, Pa.—1,667,550.

Boiler Compound. William M. Neeley, Amarillo, Tex., assignor to Neeley Chemical Company, Amarillo, Tex.—1,667,670.

Flotation of Ores. George G. Griswold, Jr., and Guy E. Sheridan, Butte, Mont.—1,668,202.

Manufacture of Fertilizers. Edward Lloyd Pease, Darlington, England.—1,668,464.

Method of Regenerating or Reactivating Catalysts. Markus Larsson, Niagara Falls, N. Y., assignor to Phosphorous Hydrogen Company, New York, N. Y.—1,668,539.

Process of Making Hydrocyanic Acid from Crude Cyanides. Guy H. Buchanan, Westfield, N. J., assignor to American Cyanamid Company, New York, N. Y.—1,667,838.

Process of Producing Potassium Ferrocyanide. Guy H. Buchanan, Westfield, and Courtland M. Hulings, Elizabeth, N. J., assignors to American Cyanamid Company, New York, N. Y.—1,667,839.

Process for Separating Compounds of Potassium from Compounds of Aluminum. Hans Joachin Falck, Notodden, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Oslo, Norway.—1,667,968.

Chemical Engineering Processes and Equipment

Withdrawal of Vapors and Gases from Galvonotechnical tanks. Wilhelm Anton Franz Pfanhauser, Leipzig, Germany.—1,664,482.

Process of Stabilizing Chemical Substances. Hans G. Grimm, Munich, Germany.—1,664,678. *Coloring fibers.*

Method of Measuring the Density of Gas. Georg König, Berlin-Dahlem, Germany.—1,664,752.

Pulsometer. Albert Paul Japy, Berne-Seloncourt, France.—1,664,927.

Process for Clarifying Liquids. Antonio Vallée y Gumá, Habana, Cuba.—1,665,167.

Acid Pump. Aladar Hollander, Berkeley, Calif., assignor to Byron Jackson Pump Mfg. Co., Berkeley, Calif.—1,665,458.

Electric Furnace for Treating Ores, Shales, Etc. Francis E. Hatch, Denver, Colo.—1,665,546.

Pulverizing Machine. Ernst H. Elzemeyer, St. Louis, Mo., assignor to American Pulverizer Company, St. Louis, Mo.—1,666,124.

Temperature-Regulating System. Chester E. Andrews, Carnegie, Pa., assignor to the Selden Company, Pittsburgh, Pa.—1,666,251. *By reflux condensing.*

Cake Former for Continuous Rotary Filters. Robert O. Boykin, Los Angeles, Calif., assignor to N. Russell Vail, Los Angeles, Calif.—1,666,279.

Mixing Machine. Herbert H. Hackstedde, Cincinnati, Ohio.—1,666,285.

Cutting Machine. Max Edelman, Sellersville, Pa., assignor to Esther M. Shapiro, Sellersville, Pa.—1,666,643.

Separator for the Electrodes of Electrolytic Cells. Joseph Lester Woodbridge, Philadelphia, Pa.—1,666,762.

Pressure Still. Alfred James Sloan, Kansas City, Kan., assignor to Sinclair Refining Company, Chicago, Ill., a corporation of Maine.—1,667,055.

Water-Feed-Control-System for Boilers. Ira E. Smith, Stockton, Calif.—1,667,057.

Gas and Liquid Contact Apparatus. Clive M. Alexander, Tulsa, Okla.—1,667,136.

Gas Separator. John F. Borden, Alameda, Calif., assignor to Oliver Continuous Filter Company, Oakland, Calif.—1,667,139.

Steam Turpentine Still. Jesse O. Reed, Paxinos, Pa., assignor to the Government and the People of the United States of America.—1,667,168.

Rotary Pump. Frank Arnold and Walter Randolph, Oakland, Calif.—1,667,183.

Filter and Filtering Method. Justin F. Wait, New York, N. Y.—1,667,465.

Apparatus for Spraying and Treating Liquids. Charles O. Lavett, Buffalo, N. Y., assignor, by mesne assignments, to Buffalo Foundry & Machine Co., Buffalo, N. Y.—1,667,291.

Centrifugal. Carl Schaum, Philadelphia, Pa., assignor to Fletcher Works, Incorporated, Philadelphia, Pa.—1,667,493.

Production of Emulsions. Carl Alexander Agthe, Zurich, Switzerland.—1,668,136.

Valves. Sven, Johan Nordstrom, San Francisco, Calif., assignor to Merco Nordstrom Valve Company, San Francisco, Calif.—1,668,168.

Apparatus for Determining the Degree of Fineness of Pulverulent or Fine Granular Masses by Means of Suspension. Hermann Harkort, Berlin-Tegel, Germany.—1,667,783.

Method of and Apparatus for Heating and Deaerating Water. George H. Gibson, Montclair, N. J., assignor to Cochrane Corporation, Philadelphia, Pa.—1,667,850.

Magnetic Relay Valve. Horace A. Mitchell, Fairfield, Conn.—1,667,850.

Agitator. Edgar B. Nichols, Rochester, N. Y., assignor to The Pfaudler Company, Rochester, N. Y.—1,667,944.

News of the Industry

Interesting Papers Read at Nitrogen Conference

REPRESENTATIVES of fifteen countries attended the Second International Nitrogen Conference held on the steamer *Luetzow* while cruising in the Adriatic Sea. The conference opened on May 1 under the direction of Sir David Milne Watson of England, president of the conference. The first address was delivered by Dr. J. Bueb of Germany who spoke on "The Nitrogen Industry, its past and future development." Sir Alfred Mond, England, Henry Gall, France, and Dr. Axel Aubert, Norway, participated in the discussion. F. C. O. Speyer, England, also spoke on "Some Nitrogen Problems."

On May 2 the conference was opened with an address by Prof. L. Bretigniere, France, on "Cultivation of the Soil in Relation to Nitrogenous Fertilizers." He was followed by Sir Frederick Keeble, England, whose subject was "Research and Education in Relation to Practical Farming" Professor Armstrong, England, led the discussions. Professor Warmbold, Germany, opened the third session with a talk on "The Natural and Economic Basis of the Application of Artificial Fertilizers." Schurig Zeistow and Professor Bosch, Germany, took up the discussion and credited the lowering of nitrogen prices to the synthetic nitrogen industry. G. Fauser, Italy, also read a paper on the production of concentrated nitric acid by oxidation of ammonia under pressure. The last two days of the conferences were featured by addresses from Dr. A. Demolon, France, Dr. Erwin Baur, Germany, Prof. F. E. Bear, United States, J. S. Carroll, England, and J. Galland, France.

IT WAS the opinion of the conference that increased consumption of plant food would be the greatest factor in preventing excessive future prices for the necessities of life. Towards this end the members advocated that the nitrogen industry construct plants at points where lowest possible production costs were possible, use modern scientific and technical improvements, and conduct extensive research work. Those engaged in agriculture, research, and educational work also were regarded as factors of importance in increasing consumption of fertilizers. It was held that the various governments might aid in this movement by promoting and supporting institutions to provide ample credit to assist farmers in their purchases.

Chemical Interests Donate To A.C.S.

GIFTS to the American Chemical Society aggregating $360,000 for the support and improvement of *Chemical Abstracts* in recording and indexing the chemical literature of the world, were announced during the Society's meeting in St. Louis April 16-20. The largest single contribution was for $250,000 presented by the Chemical Foundation of which Francis P. Garvan is president. The remaining $110,000 came from the chemical industries to whom a special campaign has lately been directed by the officers of the Society. The leading donor in the industrial list was the Allied Chemical & Dye Corporation of which Dr. William H. Nichols is chairman of the board.

Paul Kruesi New President of A.E.S.

AT THE business session of the meeting of the American Electrochemical Society held last month at Bridgeport, Conn., Paul J. Kruesi, president of the Southern Ferro Alloys Co., was elected president of the society succeeding Dr. S. C. Lind. Acheson Smith was re-elected treasurer and Colin G. Fink, secretary. The new vice-presidents are: F. C. Frary, Director of Research, Aluminum Co. of America; F. N. Speller, Metallurgical Engineer, National Tube Co., Alfred Stansfield, Professor of Metallurgy, McGill University. The new managers, F. M. Becket, vice-president, Union Carbide and Carbon Co., L. E. Saunders, manager, Abrasive Plants, Norton Co., S. Skowronski, research chemist, Anaconda Copper Co., Raritan Works.

Electrochemists Will Meet on May 18

The spring meeting of the New York Section of the American Electrochemical Society will be held at the Chemists' Club, New York City, on Friday, May 18, at 6:30 p.m. Dr. R. M. Burns of the Bell Telephone Laboratories will open the discussion with a talk on the characteristics of electrolytic, stray current and chemical corrosion of lead cable sheath and the resulting problems in underground cable maintenance.

Administration Changes in German I. G.

ADVICES to the Department of Commerce state that there has been a reorganization in the I. G. Farbenindustrie of Germany. After the big fusion, it was found to be easier to reorganize the plant output than to reorganize sales and management. Some time elapsed before it was generally recognized that drastic action in the latter regard was necessary. Dyestuffs sales were concentrated in four offices with territories divided according to state boundaries. This, it appears, proved a serious mistake, and soon it became apparent that the amalgamation of these offices in Frankfort would be desirable. The same experience was evident in the case of pharmaceuticals which at first were located in Leverkusen and Höchst. It is now planned to centralize the sales of pharmaceuticals in one office.

The history of the I. G. Farbenindustrie, according to Dr. Bosch of that company shows a development from a form of absolutism to a council system; from a general director for the former single companies to a council of two, and from this council to a larger board with a chairman. On this principle the management of the I. G. Farbenindustrie was formed, and, although it was recognized that a smaller board would be advisable, it was found necessary for personal reasons to include all the members of former boards in the new board. From this, however, a smaller working committee of 26 was chosen. This committee now meets in Frankfort every three or four weeks, when matters which had already been discussed by expert committees and prepared for decision are considered. Moreover, at such meetings the general outlines of the company's policy are drawn up.

In the expert committees, to which the directors of all the single departments belong, the real work of the concern is accomplished, complemented by the co-operation of numerous technical and subcommittees. The board members who do not belong to the working committee of 26 act as heads of departments. In view of the responsibility borne by them, they are entitled to full knowledge of the decisions of the working committee of 26, and to demand a fresh consultation on any subject either in their own presence or in the presence of other authorities.

Prominent Speakers Address Chamber of Commerce Members

Sixteenth Annual Convention Featured By Adoption of Constructive Resolutions

THAT THE Chamber of Commerce of the United States has come to be a great and constructive force in American business was demonstrated at the sixteenth annual convention of that organization, which was held in Washington May 8 to May 11. While the feature of the convention was the striking keynote speech of Judge Edwin B. Parker, who had served during the year as the head of the Chamber's Board of Directors, and the unusual resolution which grew out of that address, there were many other important developments growing out of the meeting.

With Judge Parker's opening address centering attention on the subject of the responsibilities of business in connection with the maintenance of high moral and ethical standards, that subject became one of the chief topics of conversation. None differed with Judge Parker's conclusions. The desire of everyone, apparently, was to devise means of making the policy most effective. So strong was the demand for action along that line that the Board of Directors was called into special session to express the sense of the meeting in a formal resolution.

The resolution, which was adopted unanimously, declared that American business "insists upon protecting its professional status by the maintenance of the highest standards." It was made clear that there is all confidence in the general integrity and sound ideals of business in that these qualities are emphasized only by violations of established practices. These violations, it was pointed out, bring business into disrepute and shock the sensibilities of all decent citizens. The purging of corruption and unclean and unworthy practices from business was held to be chief among the responsibilities which face the commercial men of the nation.

THROUGHOUT the sessions, there was evidence of increased determination to take a more active stand against the entry of the government into the field of business. This, too, was emphasized in a formal resolution which decried the entry of the government into any phase of business when the activity can be conducted in the public interest by private enterprise. "Any tendency of the government," says the resolution, "to enter such fields should be weighed carefully in the light of its possible effect upon the very genius of our institutions."

The efforts at this session of Congress to limit the authority of the federal courts, particularly in the matter of issuing injunctions, brought forth vigorous protest. The Chamber went on record deploring "any and all efforts to obtain the adoption of legislation which tends to minimize the power or diminish the jurisdiction of the federal courts, or to substitute the legislative will for the discretion of the judge in the discharge of a judicial duty."

Reduction of the corporation income tax so that it will not exceed ten per cent, the repeal of the estate tax and the elimination of war excise taxes on particular businesses were urged. Despite the criticism which has been hurled at the Chamber's stand on taxes there was unanimous support for a continuance of the existing policies. The view was widely held that business had been too complacent in allowing itself to be loaded with an unfair portion of the tax burden. Year-end surpluses should be returned to taxpayers in proportion to the amounts they have paid, it was held in one of the resolutions adopted. A plea was made for better tax laws and for more business-like regulations to be followed in their administration. There were declarations against retroactive provisions.

MATTERS pertaining to the merchant marine have been given special prominence in the work of the national Chamber. Attention was called to the fact that pending legislation provides for the encouragement of ship building, for favorable contracts for the carrying of mail and for payments to officers and men of the merchant marine who enlist in the naval reserves. Congress should make definite provision for the placing of all essential marine services in responsible private hands in such a way as to assure permanency of operation.

Import association similar to those now engaged in export activities were advocated in one of the resolutions adopted. Such organizations for the collective buying of raw materials as have come under the domination of foreign monopolise should be made legal, in the opinion of those in attendance.

Increased appropriations for the Bureau of Mines and for the Geological Survey were specifically advocated for research work looking to the location of mineral deposits which do not outcrop on the surface.

The policies of the Department of Commerce for the promotion of commercial aviation were commended strongly. The enactment of state legislation in harmony with the federal law was urged.

A census of distribution as a part of the decennial census "will be of value to every branch of industry and commerce," it was held. There was strong demand for the unification of ocean bills of lading and the Chamber urged the adoption of the Hague rules made to conform to American conditions. In another resolution, international commercial arbitration was held to be highly desirable.

That the trade associations are becoming an influential and fundamental factor in the Chamber's organization was particularly apparent at this meeting. It is evident that these associations are displacing Chambers of Commerce, as the basic point of contact with certain phases of business.

BY THE selection of a particularly strong group of officers the importance that the National Chamber has assumed is certain to be increased during the coming year. As a result of his long experience in the active work of the Chicago Association of Commerce and of the Illinois Chamber of Commerce, Joseph Holton Defrees, who was chosen to head the Board of Directors, is particularly qualified to fill the most important post in the Chamber's organization. William Butterworth, the new president, who has had such an important role in the successful manufacturing career of Deere and Company, of Moline, Ill., as a youth was in the government service. As a result of the knowledge of the government machine acquired at that time, he has followed closely the progress of legislation and its effect on business. In addition to his manufacturing experience, Mr. Butterworth has participated in an important way in banking and in the operation of public utilities.

With such men as Alfred J. Brosseau, the president of Mack Trucks, Inc.; Robert R. Ellis, president of the Hessig-Ellis Drug Co., of Memphis; Robert P. Lamont, president of the American Steel Foundries of Chicago and Paul Shoup, of the Southern Pacific Company, as vice-presidents, the new administration is believed to be unusually well officered.

Cooperative Efforts in Automobile Industry

At the annual session of the Chamber of Commerce of the United States, Alfred Reeves, general manager of the National Automobile Chamber of Commerce made an impression on his audience by reciting in considerable detail the co-operative efforts of the automobile manufacturers. He cited the great benefit from the system of cross-licensing of patents, whereby every member of the Chamber can use all the patents of every other manufacturer member without royalty. There are now 700 patents under the cross-licensing agreement. As a result, there has been no patent suit in 14 years. As a result of the interchange of patents, the whole industry has been able to progress rapidly through the joint use by all of the best ideas of each manufacturer. The abandonment of all secrecy regarding production methods was also cited as a profit-making co-operative action of the entire industry.

NEWS FROM WASHINGTON

By Paul Wooton
Washington Correspondent of Chem. & Met.

THE MUSCLE SHOALS bill, characterized in the debate as the most radical measure to attain such an advanced legislative status, came before the House May 9 on calendar Wednesday. This limited the consideration of the bill to a single day. An effort was made to hold a night session, after debate had been limited to one hour, but a motion to adjourn was carried 169 to 157. That vote indicated that the House is very closely divided on the bill.

Since the adoption of the public-operation bill by the Military Affairs Committee, after efforts had failed to agree on other measures, the National Fertilizer Association has been active in its fight against the legislation. No opportunity was given by the committee for opponents of the measure to be heard. In an effort to get its side of the case before Congress the Association then resorted to use of full-page advertisements in the Washington papers. It was pointed out that property which cost $140,000,000 was being turned over to the government corporation without interest, rental, or other charges. In addition, it was to receive $10,000,000 of operating capital from the United States Treasury on which no interest is to be paid for five years. Besides the corporation is to have the income from surplus power which, according to the Corps of Engineers, is worth from $3,500,000 to $4,500,000. The power income is to be deducted from fertilizer costs, thus subsidizing fertilizer prices, the Association contends.

REPRESENTATIVE GARRETT, the minority leader, pointed out in an impassioned speech that "for the first time in all the history of the country it is deliberately proposed that the Federal Government shall go into business for business' sake. This bill is not to promote navigation. This bill is designed deliberately to put the federal government into two avenues of business. The Committee on Military Affairs has determined deliberately to take from the state in which the greatest water power possibilities exist, the control over the water powers that are on the particular stream that the Cove Creek dam will affect."

The House, however, voted down 46 to 125, Mr. Garrett's amendment that the government corporation be subject to local taxation and other laws of the states in which it operates to the same extent as would a private corporation engaged in such enterprises.

The general belief of observers in Washington is that more will be done on the yacht *Lützow*, which is cruising in the Adriatic, as this is written, with an international party of representatives of the nitrogen industry on board, than give consideration to the technical and academic subjects which have been announced. Some of the prominent leaders in the industry are expected to come to understandings on that trip which will not be advertised. The general belief is, however, that the nitrogen syndicate of Germany is sincere in its desire to keep nitrogen prices low and to encourage its use in every way possible. The United States is represented on this trip by Lammot Dupont, president, and James B. D. Edge, vice-president of the Dupont Company; by M. N. McIlravy, the chairman of the board of the Barrett Company; by Cullen Morris, president of the Consolidated Gas Company, New York; by Dr. Asher Hobson and Dr. Harry Curtis, representing the U. S. Department of Agriculture.

THAT consolidation of interests within the chemical and allied industries is proceeding at a rapid pace in practically every country in Europe, is indicated by reports reaching Washington. Italy, Switzerland and Belgium are about to enter the International Chemical Cartel with France and Germany. In the field of dyestuffs it is believed that the agreement involves Germany, France and Italy. While there is some doubt as to whether or not Belgium and Switzerland have signed up, it has been apparent for some time that some sort of working agreement is in existence and open participation probably will not be long delayed. The centralization of the dyestuffs industry in Czechoslovakia leads to the expectation that an agreement will be reached there as well.

Germany is expected soon to become a party to the recent pharmaceutical agreement between France and Switzerland. The Italians are reported to have joined the long-standing explosives combine which includes practically all of the Continental countries along with the United Kingdom.

One of the most complete and successful agreements that has been worked out in Europe is one involving the rayon industries of Germany, England, France and Italy. Some suspect that certain of the rayon plants in this country are parties in some way to the international rayon situation or at least that there is some common interest.

The International White Lead Convention has more than five years to run and has shown its effectiveness in stabilizing world markets and prices through regulation of production in member countries. Some sort of an agreement is believed to exist between Norway, Germany and France in connection with the trade in titanium oxide. An American company is party to the agreement under the terms of the license under which it uses the Norwegian patents.

AMERICAN bankers continue to participate in world chemical affairs. The organization of the Finance Company of Great Britain and America is regarded as a highly significant recent development. This Anglo-American tie-up includes the Imperial Chemical Industries, Ltd., of Great Britain. There is reason to believe also that American bankers are co-operationg with the German I.G., and with the Kuhlmann Company, of France.

Some go so far as to predict that ultimately there will be a continental European convention with Germany occupying the dominant rôle. The British are expected to engineer a chemical combine of their own with the United States forming a third great independent interest in the field.

Two subsidiaries have been formed by the Montecatini company of Italy, says a report to the Department of Commerce. One is the Societa Italiana Ammonia capitalized at 150,000,000 lire. The other is the Societa Italiana del l'Alluminia, capitalized at 80,000,000 lire. The latter company expects to operate exclusively on Italian bauxite and will use the electric oven process so as to eliminate the need for coal. The ammonia company is planning to produce phosphate of ammonia. To save coal in this instance, the chemical means of reduction will be employed, rather than electric furnaces. This will have the advantage, it is stated, of creating an outlet for Italian pyrites and sulphuric acid.

Pethanol is the name applied to a new insecticide which the Germans have brought out for use in spraying trees and plants. It is claimed that a one per cent solution of the insecticide is ample to kill all plant pests and at the same time is not strong enough to injure leaves or fruit.

Producers, distributors, and organized consumers of Stoddard Solvent (petroleum distillate for use as a dry-cleaning solvent) are being circularized by the Commercial Standards Group of the Bureau of Standards, for written acceptance to the commercial standard, approved by a general conference recently held at the Department of Commerce.

This commercial standard stipulates the minimum requirements for the preparation of this dry-cleaning solvent. At least 65 per cent of the known producers, distributors, and organized consumers must accept the standard in writing before it will be published by the Department of Commerce.

In the communication sent the industry, the Commercial Standards Group stated that "while the action of the first general conference is based on a careful study of conditions and requirements, it will be susceptible of such modifications as future trends in the industry may render desirable."

British Chemical Industries Maintain Steady Position

New Companies Organized in the Gramophone and Safety Glass Fields

From Our London Correspondent

THE STEADINESS of chemical markets and of the chemical industry has perhaps been an outstanding feature during the present year and they have also been singularly free from the usual type of rumors which affect the stability of highly technical industries. In the coal industry signs are not wanting that the corner is about to be turned, even if still lower prices are by no means improbable pending reorganization. The advent of very high steam pressures and the possible application of chain grate stokers and pulverized fuel to marine boilers has perceptibly checked the otherwise triumphant progress of the Diesel-engined or oil-fired ships. In fact the technical press is full of controversy and argument in regard to relative merit and efficiency and it is even predicted that in the near future the consumption of coal in steamships will tend to rise. The opposite is of course the case in regard to the consumption of steam coal for the Navy and with regard to the coal output restriction schemes that have been mooted or put into effect, these are as likely to defeat their own ends as the rubber restriction scheme which is now coming to an end. One effect of restriction was to prevent certain orders for coal in Northumberland being executed and this without any effect on prices. The present dispute in the Ruhr district of Germany and the probability of higher wage rates which are likely to be conceded prior to the German elections have also produced a certain amount of optimism, but it seems most unlikely that there will be a coal strike or even anything in the nature of a political strike in Germany until the elections are over.

The shares of Imperial Chemical Industries continue to rise in value, partly as a result of the excellent showing and dividends for the past year and partly on account of the formation of the Finance Company of Great Britain and America.

THE I.C.I. Magazine is still increasing in size and in circulation, there being now some 35,000 readers, while those outside the combine are discouraged from obtaining copies. The April issue includes an illustrated description of the new I.C.I. central offices, by Sir Frank Baines, F.R.I.B.A., the architect. The building is nearing completing, not far from the Houses of Parliament, on the river bank and is likely to be a great architectural and commercial success. The executive offices are near the top floor to avoid noise. Above this floor there will be a refectory the whole length of the street front and the arches are each surmounted by sculptured portraits of eminent chemists and of those associated with the chemical industry. These include Alfred Nobel, Dr. Ludwig Mond, Joseph Priestley, Lavoisier, Von Liebig and Sir Alfred Mond. The basement of the building will also contain squash racquets and badminton courts, a large gymnasium and a rifle range, together with the usual workshop and strong room accommodation. Interesting features are a radiant system of hot water panels for heating and the use of daylight lighting from which the red ray has been cut off. Moreover, it is rumored that the new vita glass which is being marketed by Messrs. Pilkingtons, is to be used extensively, thus admitting the ultra violet rays of sunlight which are cut off by ordinary glass. The London Stock Exchange usually manages to give very suitable nicknames to the shares of joint stock companies, and it was therefore both interesting and amusing to learn from an evening paper a few days ago that I.C.I. shares, partly on account of the association with the concern of the Mond family and of Lord Reading have been nick-named "Ikeys," and it seems likely that the name will stick.

The prosperity of the gramophone industry is still producing a crop of new issues of all kinds. The Goodson Gramophone Record Company, Ltd., is being floated with a capital of $1,250,000 to manufacture and market a new type of gramophone record which is of some chemical interest. Goodson's English patent specification 271,796 discloses the use of a thin celluloid gramophone disk, printed on one or both sides, the printed matter and also the sound waves, being indelibly fixed at a pressure of 1,800 to 2,000 lb. per sq.in. and at a temperature of about 220 deg. F. Further patents have been applied for but it is understood that to some extent the manufacture of the new record will be carried on as a secret process. Suffice it to say that the records are of excellent appearance and are stated to be almost unbreakable, yet giving almost perfect tone production.

THERE has been further activity in the Splinterless Glass field referred to last month, and two new companies each with about $1,000,000 capital have been formed under the names Safetex and Xetal Safety Glass respectively. In both cases a reduced cost of production and other advantages are claimed. Safetex glass is made under the patent of G. B. Riley, and English Specification No. 237,379 gives details of the solution and varnishes used, both for the glass and the intermediate sheet of celluloid. Isinglass and dextrine are the principal ingredients for the former, while the varnish for the celluloid contains rosin, castor oil and white shellac. A temperature of 120 deg. to 230 deg. F. at a pressure of about 1 atm. is used to unite the glass and celluloid sheets.

In connection with the recent controversy regarding the safety in use of gasoline containing lead tetra-ethyl, the government has now appointed an interdepartmental committee which includes the government chemist Sir Robert Robertson, Dr. Lander, Director of Fuel Research and A. Chaston Chapman, the well-known analytical and consulting chemist. The chief function of this committee, after inquiries, will be to report upon the precautions that may be desirable in connection with the use or handling of ethyl gasoline.

The Chemical Industry Club is showing a steady increase in membership and as a result of this and of private donations, refurnishing and many improvements in detail for the comfort of members are being carried out. Visitors from the United States who are members of the Chemists' Club of New York are given full membership privileges for a reasonable period without charge, but our readers are reminded that in the event of bedroom accommodation for themselves or their families being desired, at least a week's notice is necessary during the season and that a membership card or letter from the secretary of the Chemists' Club will assist in obviating any formalities on arrival.

At the moment of writing Mr. Churchhill is introducing his fourth Budget and the details may have a very profound effect upon the future of British industries generally. At least it will have a bearing on British credit.

New Possibilities Seen in Alcohol Synthesis

CREATION of entirely new organic chemical industries based on high pressure syntheses using carbon monoxide and similar cheap raw materials was forecast by Dr. Per K. Frolich of M.I.T. at a joint meeting of the chemical societies held in New York, May 4. At the same session Dr. B. T. Brooks, consulting chemical engineer, discussed the polymerization of hydrocarbons. He showed the mechanism, from the viewpoint of the organic chemist, of type reactions that have industrial significance in the refining of petroleum products with fullers earth and in the production of synthetic rubber and resins.

Doctor Frolich pointed out that intensive research work in the past few years has demonstrated the possibility of synthesizing practically any aliphatic organic compound by the catalytic conversion at high pressure of CO and H_2. In addition to pure methanol, it is easily possible to produce ethyl, butyl, propyl and amyl alcohols by variation of the catalysts used. In fact it is through the development of catalysts exceedingly selective in their action that the original methanol synthesis was developed and it will be along these lines that continuous research is likely to prove most productive.

French Foreign Trade in Chemicals Declined Last Year

Exports Gained in Volume But Fell Off in Value— Low Prices for Indigo

From Our Paris Correspondent

ACCORDING to the latest statistics the net value of French chemical imports in 1927 was lower than in 1926 by over 200 million francs. On the other hand the value of French chemical exports in 1927 declined about 400 million francs. In quantity, however, French chemical exports have increased by over 295,000 tons in 1927, 2,770,000 tons in 1926 versus 3,065,000 tons in 1927. This increase in quantity and decrease in value are partly due to the rise and steadiness of the French franc and by the rather surprising fact that the French chemical industries are actually dumping stocks. The following example will illustrate this statement. Synthetic indigo made in France is sold in this country on the basis of 12 French francs per kilo. In Belgium, however, a kilo of the same French made indigo paste may be obtained at 5 Belgian francs 85 to 6 Belgian francs 25, equivalent to 4 French francs 10 to 4 French francs 40.

This depreciation of prices is caused by the three and four year contracts drawn in 1925 by the French indigo manufacturers at the above quoted prices in order to capture the export market. According to reports these contracts extend to the end of 1928. In spite of these low prices the I.G., in order to keep part of the export market, offers synthetic indigo in Belgium at the "official" price of 7 Belgian francs per kilo with a "confidential" discount of 75 Belgian cents per kilo.

Before the war the same indigo paste was commonly sold in France from two to two francs fifty. Owing to the depreciation of the present day franc indigo paste should not be sold over or less than 10 francs a kilo. This coloring matter has therefore risen 20 per cent in France, a most abnormal rise. It should be noted that in 1904, at the time of the commercial war between the German factories, synthetic indigo contracts were made in France on the basis of 1 French (gold) franc 20 to 1 French (gold) franc 50 i.e. 6 French (paper) francs to 7 French (paper) francs 50.

IN A recent conference M. Ch. Berthelot showed that the French coal trade had to face an entirely new situation owing to the following reasons: The world coal production increases whilst the world consumption decreases owing to the growing use of liquid fuels and hydraulic power; the opening of the new coal deposits and especially the production of the Belgian Campine coal mines; the application of modern machinery in the coal mines.

The yearly total overproduction of coal in Europe is estimated at 80 million tons. On the other hand the consumption of liquid fuels is increasing rapidly. In France this consumption doubles every three years and three months. The remedy for this complex and dangerous situation for our national economy is the chemical treatment of coal i.e. producing from coal well defined and properly isolated fuels especially used for the preparation of hydrocarburets and nitrogen fertilizers. Finally the necessary average coal consumption to obtain 2 million tons of carburants—which corresponds to about one-fifth of our needs in 1935—would be 12 million tons. This figure seems incredibly high but its value corresponds only to 1,200 million paper francs whereas the hydrocarburets thus obtained would be worth 3 billion paper francs. The world coal and lignite fields contain over 7 billion tons quite a sufficient quantity to cope with the world needs during several hundred years. This ensures a comparative security to all industries which are bound to alter their means of power production starting from coal and lignites.

The French coal mines contemplate the converting of solid fuels into liquid fuels owing to the following reasons based on the general economy of the country: the consumer could be supplied with both solid and liquid fuels, a great advantage commercially speaking as coal and liquid fuels do not have always the same demands; two million tons of liquid fuels can easily be stocked whereas twelve million tons of coal cannot; fuels would be sold by long-time contracts in order to insure the 70,000 workers of the coal and liquid fuel trades against unemployment.

This plainly shows why the coal trade fathers the new synthetic liquid fuel trade and the new synthetic nitrogen fertilizers trade.

TWO kinds of synthetic carburants of different quality have been obtained from coal, methyl alcohol and gas oil. Methyl alcohol's drawback is its high cost price and its small calorific power. Its advantage is that it is now easily obtained in large quantities. The Béthune Mines have already a daily output of several tons; the Courrières Mines will shortly do the same and another big coal mine of Pas-de-Calais contemplates the building of a special converting factory giving a daily output of 100 tons of methyl alcohol. This clearly shows the entire confidence of the coal mines in the new converting methods.

Mr. Berthelot also stated what rules should be followed in the building of modern coke plants in order to increase their carbonization power per day-oven. According to his statements an oven-worker placed under favorable conditions should be able to transform 35 tons of coal daily. In the Ruhr districts only coke-ovens heated by mixed gas are built. This enables the release of the gas contained in the oven, which is always rich in hydrogen, and its use for synthesis operations.

Mr. Berthelot also drew attention to the relative deficiency of our hydrogen supplies. Though they are believed to be superabundant they do not reach 500 million cubic meters yearly corresponding to 200,000 tons of ammonia or 300,000 tons of methyl alcohol, a small quantity if compared with our needs, viz.: 1,500,000 tons of carburants for the present year and 7 million tons of carburants in 1935. This is the reason why Mr. Berthelot seeks the solution of the problem in other sources of hydrogen production.

ANOTHER source of hydrogen production could be created by electrolysis of water. Hydrogen thus obtained is quite unadulterated but in spite of that its cost price is higher than that of hydrogen obtained starting from water gas. It should not be overlooked, however, as it would be the means of cutting down the working expenses of a super electrical plant of 200,000 kw. built in the Northern mining district area and able to supply with electrical power not only the Northern, Somme and Pas-de-Calais districts but also Paris and its suburbs whose needs increase yearly by 100 million kw.

Finally Mr. Berthelot drew attention to the large necessary capital to be invested in works transforming coal into carburants. He gave as example the German works of Merceburg, built for a yearly output of 120,000 tons, whose price would come to 240,000,000 francs.

Dean Kimball To Serve as Consulting Editor

DEAN Dexter S. Kimball, of Cornell University, has accepted the Consulting Editorship of the new "McGraw-Hill Industrial Management Series." The first volume in the series will be "Standards and Standardization," by N. F. Harriman, senior engineer-physicist, National Bureau of Standards; vice-chairman, Federal Specifications Board; member of the Federal Purchasing Board and Bureau of the Budget, U. S. Government, and will be published during the summer. Other subjects to be covered are: "Industrial Economics," "Location, Arrangement and Construction of Industrial Plants," "Control of Production," "Transportation and Handling of Materials," "Time and Motion Study," "Industrial Accounting," "Purchasing," "Corporate Ownership," "Industrial Relations," "Safety and Accident Prevention," "Forecasting and Budgeting," "Industrial Marketing," and "Industrial Research."

News in Brief

THE SECOND NATIONAL Meeting of the Fuels Division of the American Society of Mechanical Engineers will be held in Cleveland September 17-20, 1928. A comprehensive program is being planned, which will include papers by a distinguished group of nationally recognized authorities dealing with the production, distribution and efficient utilization of fuel.

DR. JAMES J. DURRETT of Memphis, Tenn., is to succeed Dr. George W. Hoover in charge of Drug Control in the Food, Drug and Insecticide Administration, it was announced today by W. G. Campbell, director of Regulatory Work of the United States Department of Agriculture. Doctor Durrett's appointment is the result of his passing with first rank the civil service examination ordered when it was known that Doctor Hoover planned to resign to engage in private practice as a consultant on food and drug control matters.

BY AUTHORITY of the Secretary of Agriculture permission has been granted to the Color and Farm Waste Division of the Bureau of Chemistry and Soils to dispose of its surplus stock of calcium gluconate. Sales of this material at $2.00 per lb. will be made in pound lots to universities and research laboratories, commercial or otherwise, under the restriction that the material is not to be resold. Inquiries may be addressed to the Color and Farm Waste Division, Bureau of Chemistry and Soils.

GAS ORGANIZATIONS to meet in the near future include the Gas Products Association and the Compressed Gas Manufacturers' Association. The Gas Products Association will convene at Hot Springs, Virginia, July 10-12; the secretary is Stuart Plumley, 140 South Dearborn Street, Chicago. The Compressed Gas Manufacturers' Association will meet June 21-23 at the Seaview Golf Club, Absecon, New Jersey; F. R. Fetherston, 120 West Forty-Second Street, New York, is secretary of the association and is in charge of arrangements for the meeting. Members of the International Acetylene Association have been invited to meet with both these groups.

A PRELIMINARY agreement has been reached between the French-German-Swiss Dye Cartel and the Italian Dye-Explosives Cartel, the latter including Italgas and Montecatini, according to information received through Commerce Department trade representatives in Europe. This agreement it is said establishes quotas on dye imports into Italy based on 1927 totals, the quotas from the three countries being as follows: Germany, 70 per cent; France, 20 per cent; Switzerland, 10 per cent. It is further understood that the explosives import arrangement is practically the same as the foregoing dye stuff understanding.

THE ENKA Artificial Silk Company of Holland, one of the largest European exporters of rayon yarns to the United States, is planning to establish a large plant in this country. An American company, having the backing of European and domestic capital, will be organized, the controlling interest being retained by the Enka company. The viscose process will be used. The plant site has not yet been selected.

A MONTHLY COKE REPORT will be issued by the Bureau of Mines covering the production of byproduct and beehive coke and the use of coal in these industries. The first number of this series was issued on April 17, including statistics for the month of March, 1928, and the preliminary statistics of production of coke and estimates on byproduct production for the calendar year 1927.

SALES OF MAGNESIUM produced in the United States in 1927 amounted to 366,400 pounds, valued at $441,700, as compared with sales of 322,650 pounds, valued at $390,400, in 1926, according to J. M. Hill, of the United States Bureau of Mines. Sixty-nine per cent of the magnesium sold in 1927 was in ingot form at prices ranging from 58 cents to 93 cents a pound, and such sales increased over 6 per cent as compared with 1926. Sales of sheet magnesium in 1927 were 3 per cent of the total sales of magnesium and were 159 per cent greater than in 1926. Sales of castings in 1927 were 31,990 pounds, a decrease of 13 per cent as compared with 1926.

Anglo-German Glaubers Salt Producers in Agreement

A REPORT from consul H. C. Claiborne at Frankfort-on-the-Main states that German and British producers of glaubers salt have concluded an agreement for three years, regulating prices and dividing markets. It is stated that important consumers of the glaubers salt produced by a number of large factories on the east coast of England are the Swedish pulp manufacturers, whose demand, due to Swedish industrial difficulties, has fallen off heavily. German factories are said to be less affected than others and to have plenty of orders on hand. Hence it is alleged that the agreement with the British producers was concluded in order to prevent disturbances in the world market. Unconsumed quantities will be stored at common account, thus enabling producers to hold prices at the usual level until the Scandinavian countries again appear as buyers of the normal amounts.

Gas Production Conference at Rochester

THE second annual joint Production and Chemical Conference of the American Gas Association will be held under the auspices of the carbonization, water-gas, and chemical committees of this association on May 22-24 at the Hotel Seneca, Rochester, New York. An elaborate technical program of six sessions has been planned.

Much of the technical work of these three major committees of the association has hitherto been available only through printed reports appearing as a part of the annual convention proceedings. The object of these spring conferences is to secure more prompt presentation and more extensive discussion of the important technologic problems affecting the gas industry in a way that is not possible, because of limited time, at the annual convention. The proceedings although open to all responsible members of the industry are quasi confidential and not reported in detail, either by the technical press or by the association itself.

Among the subjects to be considered at the Rochester meeting are: Carbonizing-plant tests, economics of ammonia situation, symposium on coke production and properties, mixing gases, use of bituminous coal for water-gas making, checker-brick performance, automatic clinkering and charging of water-gas machines, treatment of gas-plant wastes, tar-separator design, recording control apparatus, liquid purification of gas, evaluation of gas oils, agglutinating test of coals, and numerous other subjects.

Chemical Association Formed By Illinois Alumni

AN ASSOCIATION of chemical and chemical engineering alumni of the University of Illinois was organized during the recent meeting in St. Louis of the American Chemical Society. A group of more than a hundred, representing about 10 per cent of the A.C.S. registration met at a luncheon in the Buckingham Hotel, April 18 at which talks were given by Prof. S. W. Parr, president of the American Chemical Society, Professors Roger Adams and D. B. Keyes of the University, Dr. L. F. Nickell, superintendent of the Monsanto Chemical Works at East St. Louis, Ill., and F. W. Kressman, vice-president and general manager of the Continental Naval Stores Co. of Laurel, Miss.

The officers of the Illinois Chemical Association for the first year are S. D. Kirkpatrick of *Chem. & Met.*, president and H. A. Shonee of Eli Lilly & Co., Indianapolis, secretary. A historical bulletin recently issued by the chemical department of the University of Illinois contains a directory showing that approximately 1,400 chemists and chemical engineers have been graduated from the department since 1872.

MEN *in Chemical Engineering*

A. E. MARSHALL, consulting chemical engineer, sailed for England on April 19. As a member of the Council of the American Institute of Chemical Engineers he will partake in arrangements for the forthcoming visit to America of the British Institution of Chemical Engineers.

HAROLD M. JOHNSON, who was successively chief chemist of the Murphy Varnish Company and president and general manager of the Johnson, McKim, Johnson Company, has joined the A. C. Horn Company, Long Island City, as director of technical service.

LOUIS BURGESS, formerly with the Standard Oil Company of New Jersey, is now associated with the firm of Hoguet and Neary, specializing in the practice of patent law.

L. A. BASSETT, president of the Hendrick Manufacturing Company at Carbondale, Pa., has returned to his office after a four months' trip in California. Mr. Bassett had recently completed fifty years of service with his firm.

J. B. GREEN, president of the Fusion Welding Corporation, Chicago, left for a vacation in Mexico City after the termination of an extended technical lecture tour in this country.

Bo HÖGLUND, a graduate of the Royal Technical University of Stockholm, who has been doing work in beet sugar on a fellowship for four years, is now in Crockett, Cal., after spending several months with the Cuba Cane Sugar Corporation in Cuba.

THOMAS STOCKHAM BAKER, president of the Carnegie Institute of Technology, arrived in New York on the *Ile de France*, April 25, after a two months' visit to Europe. He delivered four lectures in Paris, under the auspices of the Carnegie Endowment for International Peace, and devoted the remainder of his time to the interests of the second International Conference on Bituminous Coal to be held in November, having visited scientists and industrialists in all the principal countries.

J. J. SACKS, engineer for the Fusion Welding Corporation, left for Mexico City in April to spend several weeks there at the invitation of the steel works La Consolidada.

GEORGE T. LADD, president of the Ladd Water Tube Boiler Company and the Heine Boiler Company, has been elected vice-chairman of the board of directors of the Combustion Engineering Corporation.

H. D. SAVAGE has been elected president of the Combustion Engineering Corporation after serving for a number of years as vice-president. Mr. Savage has had a long period of service in the field of combustion, especially in the development of pulverized fuel. In 1916 he was vice-president of the Locomotive

H. D. SAVAGE

Pulverized Fuel Company and joined his present organization four years later.

Colonel Savage holds a number of additional offices in subsidiary companies and is an active member of the engineering societies.

JEROME STRAUSS, who served as material engineer at the United States Naval Gun Factory, Washington, D. C., has joined the Vanadium Corporation of America to do special work in engineering and metallurgy.

Mr. Strauss was a graduate with an M.E. degree from the Stevens Institute of Technology in 1913. He did work for the Illinois Steel Company and then in drop forging until 1917, when he joined the United States Army. He served until 1919 in the ordnance branch and in his subsequent capacity with the United States Gun Factory was promoted to the positions of chief chemist and material engineer.

C. E. PETERSON, staff member of the pulp and paper section of the U. S. Forest Products Laboratory, has resigned to take a position in the research department of the Champion Fibre Company, Canton, N. C., under the direction of John D. Rue.

WALTER SCHMIDT, president of the Western Precipitation Company has been elected a member of the executive committee of the American Chemical Society.

W. D. HARKINS, professor of physical chemistry at the University of Chicago, has been selected to receive the Willard Gibbs Medal for 1928. The award will be made by the Chicago section of the American Chemical Society at its meeting on May 25.

Professor Harkins' career in chemistry began with an assistantship at the University of Montana after his graduation from Leland Stanford in 1900. He continued his connection with the University of Montana, later as the director of chemistry, for twelve years, during which he also carried on studies at Leland Stanford, Chicago and Karlsruhe, Germany. Thereafter he joined the University of Chicago as assistant professor and was appointed professor of physical chemistry in 1917. Meanwhile his wide range of extra-academic activities has included chemical investigations in the Mid-West and on several U. S. government bureaus.

Professor Harkins is especially known for his work on isotopy and atomic and molecular determinations.

WILLIAM H. BAXTER of the Nitrogen Engineering Corporation of New York has recently left Norway where he was engaged since last fall in the construction and starting of the first synthetic ammonia unit of the Norsk Hydro-elektrisk Kvaelstofaktieselskab. Mr. Baxter has now proceeded to the Continent.

FRANK C. WHITMORE, chairman of the division of chemistry and chemical technology of the National Research Council and head of the chemistry department at Northwestern University, has been elected a director of the American Chemical Society to fill the vacancy resulting from the election of Prof. S. W. Parr to the presidency. Dr. Whitmore will be a lecturer at the meeting of the Society's Institute of Chemistry at Evanston this summer.

THOMAS S. TATE, who was chemist for the U. S. Glass Company, Pittsburgh, has resigned to become chief chemist of the Hocking Glass Company, Lancaster, Ohio.

LEONARD C. FLOWERS has left the Proctor & Gamble Company to join the research division of the Westinghouse Electric & Manufacturing Company.

WILLIAM MCCORMICK has resigned as Pittsburgh sales manager of the Niles Tool Works Co. and the Pratt & Whitney Co. and is now Western representative of Leeds, Tozzer & Company, Inc., New York.

ROBERT J. ANDERSON, director of research of the Fairmont Manufacturing Company, Fairmont, W. Va., was elected a vice-president of that organization at the last meeting of the board of directors.

WILLIAM MANSFIELD CLARK, professor of biochemistry and formerly of the U. S. Public Health Service was elected to the National Academy of Sciences at its April meeting.

OBITUARY

EDGAR FAHS SMITH, affectionately regarded by the chemical sciences and professions as the dean of American chemists, died of pneumonia in the hospital of the University of Pennsylvania on the evening of May 3. He had been ill for only a few days and would have been 72 years old on May 23.

Dr. Smith was born in York, Pa., where his ancestors had settled and where he continued to maintain his home later. After his early training at the York County Academy he entered Pennsylvania College, Gettysburg, and received his B.S. degree in 1872. He then went to Germany, where he specialized in the study of chemistry at Göttingen for two years, and returned to this country with a Ph.D. degree. From 1876 to 1888 he taught successively at the University of Pennsylvania, Muhlenberg College and Wittenberg College, and was then recalled to Pennsylvania to take the chair of analytical chemistry.

His final connection with the University of Pennsylvania was to last until his death. In 1892 he became head of the department of chemistry and in 1898 he was named vice-provost. When Dr. Charles Custis Harrison resigned in 1911, Dr. Smith became thirteenth provost of the university, a post which he filled until 1920. When he finally resigned as provost and as Blanchard professor of chemistry in that year, he was elected professor emeritus of chemistry.

Dr. Smith served extensively on numerous chemical and scientific organizations and government commissions, in addition to his educational and research activities. His scientific work reaped for him the highest honors both in America and abroad, culminating in the award of the Priestley medal two years ago; and it was as recently as February 29 of this year that former students and associates again attested to his lasting educational influence at a dinner in his honor in New York.

EDGAR FAHS SMITH

CALENDAR

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, convention, New York City, Dec. 27, 1928-Jan. 2, 1929.

AMERICAN CERAMIC SOCIETY, tour through France, Germany, Czecho-Slovakia and England, May 19-July 16.

AMERICAN ELECTROCHEMICAL SOCIETY, fall meeting, Charleston-Huntington, W. Va., Sept. 20-22.

AMERICAN ELECTRO-PLATERS' SOCIETY, sixteenth annual convention, Toronto, Ontario, Canada, June 25-28.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, tour, with British Institution of Chemical Engineers, Quebec, Shawinigan Falls, Montreal, Ottawa, Kirtland Lake, Port Colborne, Niagara Falls, Akron, Pittsburgh, Wilmington, Edgewood, Washington, and New York, August 18-Sept. 2.

AMERICAN IRON AND STEEL INSTITUTE, 33rd general meeting, New York, May 25.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, regional meetings, St. Paul-Minneapolis, Aug. 27-29, Boston, Oct. 1-3, Fuels Division, second national meeting, Cleveland, Sept. 17-20.

AMERICAN SOCIETY FOR TESTING MATERIALS, 31st annual meeting, Atlantic City, June 25-29.

INSTITUTE OF CHEMISTRY OF THE AMERICAN CHEMICAL SOCIETY, second session, Evanston, Ill., July 23-August 18.

NATIONAL COLLOID SYMPOSIUM, sixth symposium, University of Toronto, Toronto, Canada, June 14-16.

NATIONAL LIME ASSOCIATION, 1928 convention, New York City, May 23, 24.

A. W. GRANT, JR., who had been with the Koppers Company of Pittsburgh for the last twelve years, died in Sewickley, Pa., on April 5. Mr. Grant was born at Norfolk, Va., in 1887, graduated from the Virginia Polytechnic Institute in 1907, and from Cornell in 1909. Before joining the Koppers Company he had been with the Baldwin Locomotive Works and the United Gas Improvement Company of Philadelphia.

ARTHUR A. HOUGHTON, executive of the Corning Glass Company, died at his home in New York at the age of 61 after an illness of more than a year. Mr. Houghton, who was born in Brooklyn, in 1866, attended St. Paul's School at Concord, N. H., and immediately thereafter joined his father and brother in the Corning Glass Company, which had been founded by his grandfather, Amory Houghton. He was later president of the concern, and at the time of his death was also president of the Ephraim Creek Coke and Coal Company and a director of the Hartford Empire Company.

GEORGE F. HARVEY, president of the National Drug Company, which he founded in 1900, died in his home near Philadelphia, on April 26.

WILLIAM ROBERT QUINN, Pacific Coast representative of the Combustion Engineering Corporation, died suddenly of heart disease on April 12, while visiting New York on a business trip. He had been president of the Quinn Oil Burner & Torch Company until this firm was absorbed by the Combustion Engineering Corporation in 1922.

INDUSTRIAL NOTES

THE ROLLER BEARING COMPANY OF AMERICA, Newark, N. J., has acquired the plant of the Mercer Motor Car Company at Trenton, N. J., for manufacture of its own products.

THE PATTERSON FOUNDRY & MACHINE COMPANY, East Liverpool, Ohio, is erecting a new plant at Laughlin, Ohio.

THE VANADIUM CORPORATION OF AMERICA announces the appointment of Ward A. Miller, as vice-president.

THE ROLLWAY BEARING COMPANY, Syracuse, has appointed A. E. Munch, Jr., representative for the Chicago-Milwaukee district with headquarters at 544 Railway Exchange Building, Chicago.

THE NATIONAL FLUE CLEANER COMPANY, Groveville, N. J., has appointed the following representatives: Walter G. Heacock Co., Cleveland and Detroit; Jack Deerwester Co., St. Paul, Minn. Charles Limran, Erie, Pa.; Laid Co., Louisville, Ky.

THE CELORON COMPANY, Bridgeport, Pa., has chosen R. W. Wales as factory representative on resinous products.

THE DORR COMPANY has appointed the firm of Crossle, Scott and Duff, Ltd., Melbourne, Australia, its agents for Australia and New Zealand.

THE WAGNER ELECTRIC CORPORATION has removed its New York City sales office from 50 to 30 Church St.

THE COLUMBUS MCKINNON CHAIN COMPANY, Tonawanda, N. Y., has acquired control of the hoist division of the Chisholm-Moore Manufacturing Company.

PHILIPP BROTHERS, INC., of New York, have moved their offices into new quarters in the Woolworth Building, 233 Broadway.

THE BROWN INSTRUMENT COMPANY has installed an enlarged Pacific Coast branch at 420 South San Pedro Street, Los Angeles, Calif.

THE FOXBORO COMPANY, Foxboro, Mass., has established a branch office at 2104 Magnolia Building, Dallas, Texas, with J. B. McMahon, district manager, in charge.

THE HARRIS-DIBBLE COMPANY, New York, has moved to the Salmon Tower, 11 West 42nd Street.

THE PHILADELPHIA QUARTZ COMPANY has its enlarged Chicago offices in the Engineering Building, 205 West Walker Drive.

THE AMERICAN FLUID MOTORS COMPANY of Philadelphia has appointed H. H. Leathers, 80 Federal St., Boston, as New England agent.

THE STEUBING COWAN COMPANY of Cincinnati, Ohio, has put its new plant at Holyoke, Mass., into service.

THE YALE ELECTRIC CORPORATION has moved into its new Yale Building at 257-269 Cornelison Ave., Jersey City, N. J.

THE GENERAL REFRACTORIES COMPANY has appointed W. G. Owen, formerly of the Haws Refractory Company, to take care of sales in the Philadelphia territory.

THE WELLMAN-SEAVER-MORGAN COMPANY, Cleveland, has appointed the following distributors: Acme Well Supply Company, 136 Liberty St., New York; B. S. Burgess, Coal Exchange Building, Huntington, W. Va.; Eastern Steam Specialty Co., 270 Lafayette St., New York; Walter Heacock, Detroit; Steam Equipment Manufacturing Co., Pittsburgh; R. G. Ward, Harrison Building, Philadelphia.

THE NAZARETH FOUNDRY & MACHINE COMPANY, Nazareth, Pa., has opened an office at 810 Stephenson Building, Detroit.

THE C. W. WHEELER MANUFACTURING COMPANY, Philadelphia, has appointed the Fulton Engineering Company, Los Angeles, Calif., agents for southern California.

THE ROBINSON MANUFACTURING COMPANY, Luncy, Pa., has purchased the business and manufacturing rights of the Gedge-Gray Company, Lockland, Ohio.

THE R. D. NUTTALL COMPANY'S activities will hereafter be handled by the Westinghouse Electric & Manufacturing Company. J. E. Mullen will be in charge of the Nuttall plant in Pittsburgh.

THE DRY ICE CORPORATION OF AMERICA will begin production of the refrigerant "Dry Ice" upon the completion of its new plant at Elizabeth, N. J., in May.

THE DURALOY COMPANY, New York, announces the appointment of S. R. Adelberg to its Eastern sales office at 136 Liberty St., New York.

CONSOER, OLDER & QUINLAN, INC., are now located in the Engineering Building, 205 West Wacker Drive, Chicago.

THE PHILADELPHIA PORCELAIN COMPANY of Woodlynne, N. J., has been reorganized and plant will be completely overhauled within a short time.

THE CELITE COMPANY of Los Angeles has purchased the plant and property of the National Magnesia Manufacturing Company at Redwood City, Cal. The business of the latter company will be continued under the name of the National Magnesia Company.

MARKET CONDITIONS *and* PRICE TRENDS

Nitrate of Soda Shows Marked Gains for Fiscal Year

Revival in buying orders from European countries combined with enlarged consumption in the United States accounts for increased output in Chile.

AS A result of increased world production of synthetic nitrates, demand for nitrate of soda fell off sharply in recent years. The progress made by synthetic nitrates was widely regarded as marking a revolutionary change in the fertilizer industry and it was freely predicted that natural nitrate would find its field increasingly encroached upon as prospective enlargements in the supply of synthetic nitrates were realized.

In sharp contrast to this view in the report recently received from commercial attache Ralph H. Ackerman at Santiago. This report states that increased output and export of nitrate of soda in Chile the first quarter of this year are said to indicate that country's recovery in its chief industry.

The number of operating plants producing nitrate of soda in Chile also show a gain to 63 from 28 in operation last year. They produced 733,220 metric tons of nitrate compared with 243,627 tons the first quarter of 1927. This output is higher than the 606,518 tons made in 1925 when 88 plants were in operation. Exports for the quarter reached the high total of 860,138 metric tons compared with 531,591 tons the same period of 1927, 669,925 tons in 1926 and 754,937 tons in 1925. Exports were greater than the output this year, so stocks must have been drawn upon in order to round out the totals which have been shipped from Chilean ports.

THESE figures for the first part of this year give credence to the report that the present nitrate year promises to be one of the most prosperous in the history of the Chilean nitrate of soda industry. Sales made to date in Chile for export to various parts of the world during the fiscal year ending June 30, 1928, amount to approximately 3,000,000 tons, the largest tonnage sent from Chile during any twelve months except the war years of 1916, 1917 and 1918. Sales for the previous fiscal year of 1926-1927 were 1,950,716 tons. There was an increase of approximately 50 per cent in the current year's sales.

ONE of the most interesting phases in the increased consumption this year is the heavy European demand. From time to time there have come reports that Chilean nitrates were being replaced by other nitrogenous fertilizers in Europe, but such reports do not seem to be supported by this year's statistics. Sales of nitrate of soda for shipment to Great Britain, Europe and Egypt in the present nitrate year aggregate 1,512,000 tons, an increase of 47 per cent over the 1,027,542 tons sold in 1926-1927. This has been in the face of severe price competition from substitute materials.

Incidentally it is noted in the shipments to Europe that Russia which hitherto has taken only negligible quantities of nitrate of soda, is now receiving large amounts. As most of this is high grade material it is assumed that Russian purchases are not for agricultural purposes.

IT IS in the United States that nitrate of soda has made its greatest gain during the past year. Records of the Nitrate Producers Association show that consumption of nitrate of soda in this country has increased 55 per cent during the current year. Sales made for delivery to the United States prior to June 30, total 1,176,000 tons as compared with 754,277 tons in 1926-1927.

The deliveries of Chilean nitrates into France from June, 1927, to the end of March, 1928, have reached 240,000 tons, corresponding to the deliveries of the entire preceding year. It is estimated that receipts in April, May and June will total 50,000 tons, or a total of approximately 290,000 tons for the entire year.

In countries other than the United States, Great Britain, Europe and Egypt sales are approximately 224,000 tons, a gain of 32 per cent over last year when the consumption was 168,896 tons.

One report says that the Chilean government, expecting an increased demand, is preparing to hand over for exploitation unexplored nitrate fields, with a total capacity of ten million tons, where it is planned to instal plants capable of producing 500,000 tons annually. It is held that expansion, together with improved methods, will bring annual production up to 5,000,000 tons.

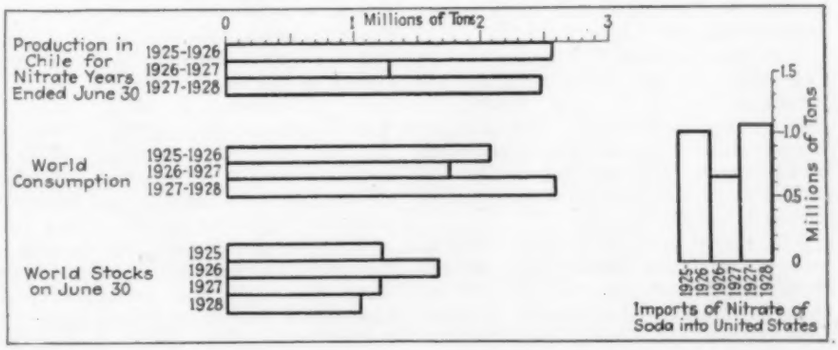
On April 16 the Chilean government announced that after an examination into costs of producing nitrate of soda and into conditions in consuming markets, it would not reduce the export tax on nitrate for the year ending June 30, 1929. This appears to have created in consuming markets a feeling of security in present price levels and is given as a reason for recent buying movement.

Spot supplies of nitrate in the United States are commanding a premium and despite recent heavy arrivals, shipments from Chile originally intended for Europe have been diverted to this country.

Production of nitrate of soda in Chile together with world consumption, world visible stocks, and imports into the United States are shown as follows, the periods representing nitrate years ended June 30 with totals for the year ending June 30, 1928, estimated.

	Production in Chile Tons	World Consumption Tons	World Visible Stocks Tons	Imports Into United States Tons
1925–26	2,578,000	2,080,000	1,674,000	1,011,673
1926–27	1,297,000	1,753,000	1,205,600	646,869
1927–28	2,475,000	2,600,000	1,050,000	1,075,000

Production Consumption and Stocks of Sodium Nitrate



ECONOMIC INFLUENCES *on production and consumption of* CHEMICALS

Chemical Manufacturers Maintain High Production Levels

Heavy Contract Shipments Absorb the Greater Part of Output

SEASONAL influences last month brought about contraction in consuming demand for certain chemicals and enlarged demand in other directions. Contract deliveries are going forward in large numbers and are accounting for a large part of current production. While new orders are not unusually large, total business is following closely the standards of the last three years. Activities in April fell off somewhat from those of the preceding month and the first four months of the year show a slight recession in the movement of chemicals as compared with the corresponding period of 1927. Production and distribution of chemicals so far this year, however, have been of large proportions and judging from the status of consuming industries no material recessions will be met in the immediate future.

Fertilizer manufacturers have been operating actively and sales of fertilizer tags from December to April inclusive were reported at 5,028,172 tons, which is the largest on record for that period. Compared with the corresponding period of last year, this represents an increase of 28 per cent. Larger sales of fertilizer are reflected in increased demand for sulphur, sulphuric acid, sulphate of ammonia, nitrate of soda, potash salts, and other fertilizer chemicals. Hence the fertilizer industry is playing an important part in holding manufacture of chemicals on its present high plane.

LATEST official figures for general manufacturing production are found in the report of the Department of Commerce and refer to March. On May 1, the department stated that production of raw materials and manufactures were increasing but still are below the records of last year. Stocks held at the end of March were larger and unfilled orders lower.

The report states that production of raw materials and manufacturing are increasing but are still below the records of last year, according to the monthly report issued May 1 by the Department of Commerce. Stocks held at the end of March were larger and unfilled orders lower, it was added.

The report states that production of raw materials in March was greater than in February but somewhat lower than in March of last year, declines from a year ago being registered in the output of minerals and the marketings of crops, other groups increasing. Manufacturing production showed a gain over the preceding month, but was slightly lower than a year ago, after adjustments of working time differences. The unadjusted indexes showed gains over the previous month in all groups except textiles, which showed no change.

STOCKS of commodities held at the end of March, after adjustment for seasonal conditions, were lower than at the end of the preceding month but slightly higher than a year ago. Declines from the preceding month were registered in all groups except manufactured foodstuffs, which increased. As compared with a year ago, stocks of raw materials, both food and other, were held in smaller quantities, while manufactured foodstuffs and other manufactured commodities showed gains.

Unfilled orders for manufactured commodities at the end of March were lower than at the end of either the previous month or March of last year. Unfilled orders for iron and steel showed no appreciable change from the preceding month but were higher than a year ago, all other groups declining from both prior periods.

Basic industries have held a satisfactory course and daily production of steel ingots established a new high record in April of 172,103 tons or a gain of 3.1 per cent over March. For the four months ended April total output was 16,846,729 tons as compared with 16,264,527 tons for the first four months of 1927. Unfilled orders for steel at the end of April, however, were lower than in March and seasonal declines in production are anticipated. Building operations are holding up well and programs for the future are a guarantee of a continuation of this condition. Automobile production is large and tire output demands large consumption of chemicals.

LESS satisfactory reports have come from the textile, tanning, and paper and pulp trades. Production has fallen off and calls for chemicals and other raw materials from that direction have been of a declining nature. As a result of this there has been an accumulation of some chemicals and resale offerings have had a depressing effect on market values. The glass trade likewise has limited demand to current requirements and the slowing up in activities which is customary during the hot-weather period promises to serve as a check to buying in the near future.

Changes within the paint and varnish industries appear to have brought adjustments in consumption of raw materials. The rapid strikes made by the lacquer industry have opened up a wider outlet for solvents. Some of the important paint pigments, on the other hand, are losing ground and in some cases it is reported that sales for the year to date are running about 15 per cent below those for the corresponding period of last year.

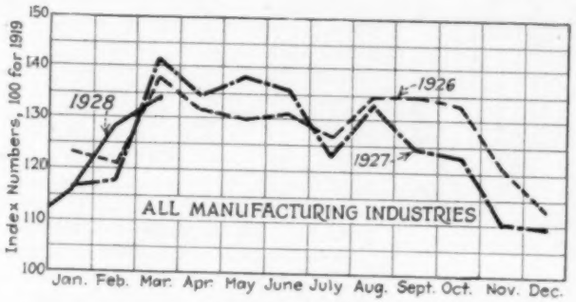
March production of crude methanol was 654,846 gal., which compares with 592,855 gal. in February and 726,694 gal. in March, 1927. Acetate of lime also gained in March with an output of 12,943,785 lb. as against 11,717,836 lb. in February. Production in March, 1927, was 14,223,334 lb.

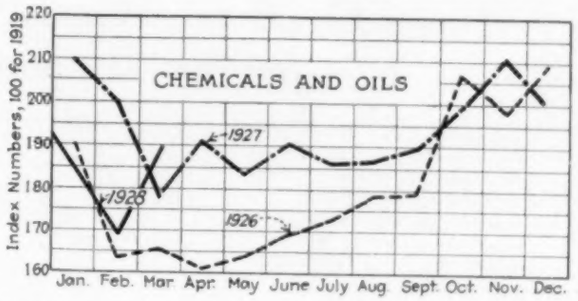
ACCORDING to a report from the Department of Commerce, United States foreign trade in chemical and allied products during the first quarter of 1928, on the whole, reflected generally favorable domestic business conditions. Total chemical exports valued at $45,000,000 were about the same as those for the corresponding period of 1926, while imports of $59,173,000 were 18 per cent greater. The apparently large imports may be explained by the tremendously increased importations of fertilizer materials, especially sodium nitrate, ammonium sulphate nitrate, and ammonium sulphate, owing to the increasing demand of agriculture for fertilizers.

During the first quarter of every year imports always have been the largest for the year and exports are usually somewhat smaller. Therefore, the difference between exports and imports for this period is normal. Other significant changes in the outward trade were the continued extensive sales of chemical specialties, sodas, and paints, with an unusually large drop in the exports of coal-tar products. Reviewing conditions in the exports of coal-tar products in the first quarter of last year it will be recalled that the United States sales were abnormally high because of depressed conditions in the British industry.

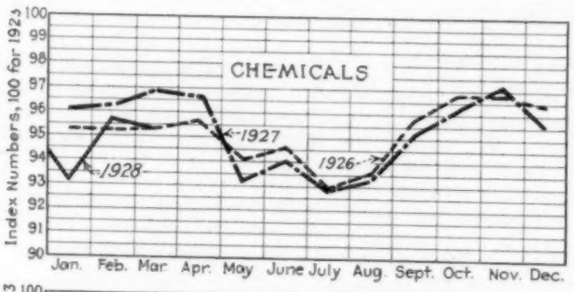
In the inward trade other noteworthy incidents were: Industrial chemicals, two-thirds as much as in the corresponding period of 1927, and only half the exports; perfume materials, half as much as in the first quarter of 1927; and coal-tar products, one-fifth more because of continued demand for creosote oil.

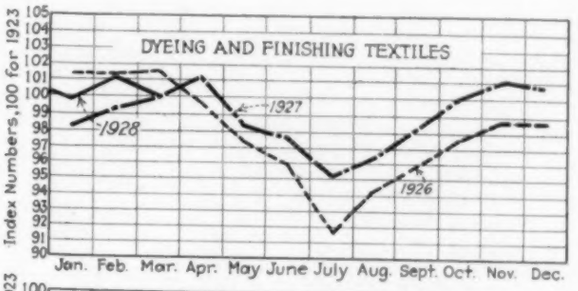
Indexes of Activity in Producing and Consuming Industries

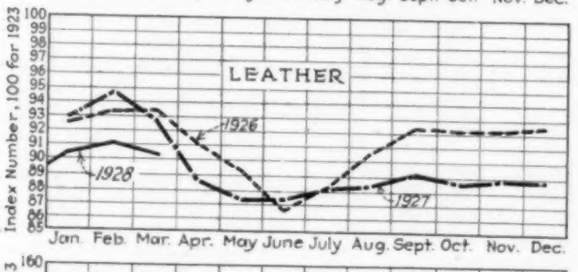


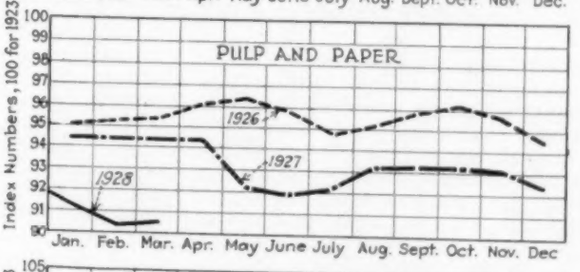


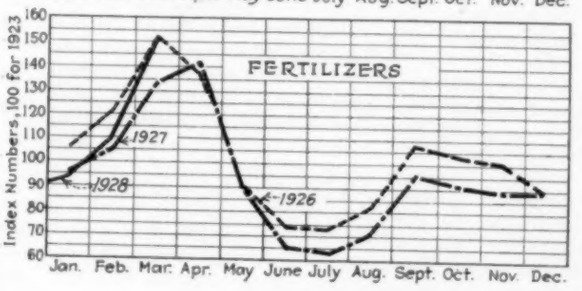
VOLUME OF PRODUCTION *(U. S. Dept. of Commerce)*

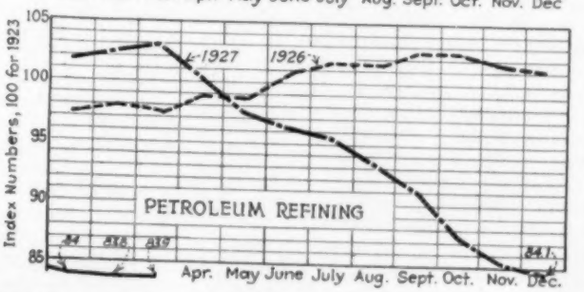




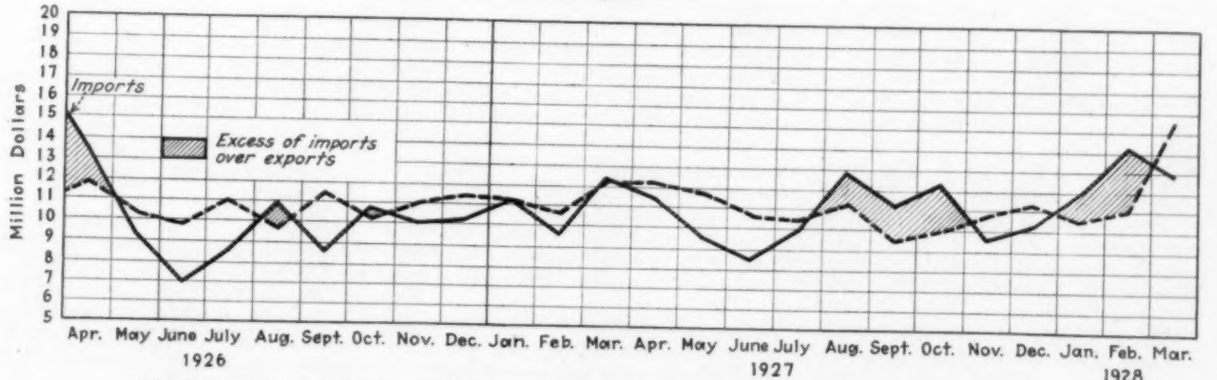








FACTORY EMPLOYMENT *(U. S. Dept. of Labor)*


Million Dollars
Imports
Excess of imports over exports
Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar.
1926
1927
1928

FOREIGN TRADE IN CHEMICALS AND ALLIED PRODUCTS

MARKET CONDITIONS *and* PRICE TRENDS

Fertilizer Chemicals Receive Active Consuming Demand

TRADING in the market for chemicals in the past month has been along broad lines but spotted conditions have prevailed and buying orders have been unevenly divided. Recent tariff action has had its effect or the increase in the import duty for carbonate of barium has had the two-fold effect of increasing domestic production and the thirty-day grace allowed by law between the time of the proclamation of the President and the application of the higher duty was taken advantage of by importers to bring in unusually large amounts of this chemical.

The recent increase in domestic production of barium carbonate also has had a market reflex in the case of sodium sulphide. Barium producers have been turning out so much of the latter chemical that the market has suffered from an oversupply and as imported material was offered in competition, relative sharp declines in prices were recorded.

Sodium sulphate also has been holding an uncertain course in recent weeks. Contract deliveries are made regularly and some of the largest producers have made no change in their price schedules. The pulp and glass industries have been buying sparingly and stocks have been piling up. This has developed selling pressure and resale offerings have tended to depress the market. Prices show a wide range according to seller but sales have been put through at very low prices and it is decidedly a buyers market. Germany has been shipping considerable sodium sulphate to southern points. In February imports were 5,806,759 lb. valued at $25,515. The present situation, however, does not seem to arise as a result of foreign competition but springs from an oversupply with difficulties in storing influencing holders to sacrifice values in order to dispose of stocks.

INCIDENTALLY the Bureau of Mines has just issued a report on domestic production of natural sodium compounds for 1927. The report shows that production of sodium compounds, not including common salt, from natural salines and brines in this country in 1927, as indicated by sales or shipments by producers, amounted to 145,770 short tons, valued at $3,834,324. These figures include the output of sodium carbonate, sodium bicarbonate, sodium sulphate, trona, and sodium borate, and show a large increase in both quantity and value as compared with 1926 partly on account of the recent development of kernite deposits. The sodium carbonates reported were all from California and amounted to 67,240 short tons, valued at $1,253,352. The sales of sodium sulphate amounted to 23,080 tons, valued at $168,882. The total boron minerals shipped in 1927 amounted to 109,080 tons valued at $3,473,399.

Tariff Investigation for Saltpeter

Under date of April 18, the U. S. Tariff Commission ordered an investigation of production costs of refined potassium nitrate or saltpeter. This is in response to an application for an increase in import duty in accordance with the flexible provisions of the Tariff act. A public hearing will be held in Washington at some future date to be designated by the commission.

Chemicals used in the manufacture of fertilizer have attracted wide buying interest. Sales of fertilizer have been unusually large and this has necessarily created a heavy demand for raw materials. Imports of nitrate of soda in March were 177,187 tons as compared with 94,151 tons in March, 1927. Arrivals were promptly moved into consumption and call for supplies was heavy enough to cause nitrate originally intended for Europe to be diverted to this country.

Sulphate of ammonia also is finding a good outlet and with domestic production sold ahead there is an increasing call for imported material.

CONSUMERS of potash salts were disturbed by recent reports that foreign producers planned to increase prices for United States deliveries. This was officially denied with the statement that the unfounded rumors of a price advance in America probably were based upon the fact that costs of potash production and importation have increased at a rapid rate. Mine wages and rail freight rates abroad are 50 to 100 per cent above pre-war, as are also ocean freight rates to America. In the face of these cost increases, the potash mines of Germany and France have been put upon a "rationalization" basis such as is advocated for the coal industry in America, and as a result the average price of potash in America has been brought down to a level lower than pre-war.

Coincident with this announcement, the N. V. Potash Export My. disclosed that the farms of America are approximately 5,500,000 tons in arrears in potash consumption, as compared with pre-war consumption here and with the current consumption of other nations. This was estimated to represent a depletion of fertility to at least 100,000,000 acres that has been sustained since 1913 by America's 344,000,000 acres of farmland.

In 1913 the American consumption was 256,561 tons and had for years been increasing at the rate of 10 per cent annually. It is estimated that if the war had not intervened the consumption in 1927 would normally have been about 950,000 tons and the total for the period 1914-1927 would have been 7,700,000 tons. Actually, however, the American consumption in 1927 was only 290,000 tons, and for the period 1914-1927 the total was only 2,131,643 tons.

Under these circumstances the Franco-German potash industry, which produces and distributes a major part of the world's potash supply, feels that it is a special duty to the American farmer to maintain potash prices at the lowest possible level in order to encourage fertilizer consumption and overcome the post-war depletion of the nation's natural soil fertility.

The increasing hold on domestic markets attained by home producers of sal ammoniac is attested by the fact that in March, importations were 921,029 lb. as against 1,455,736 lb. in March last year. Imports for the year to date are about 50 per cent below those for the corresponding period of last year.

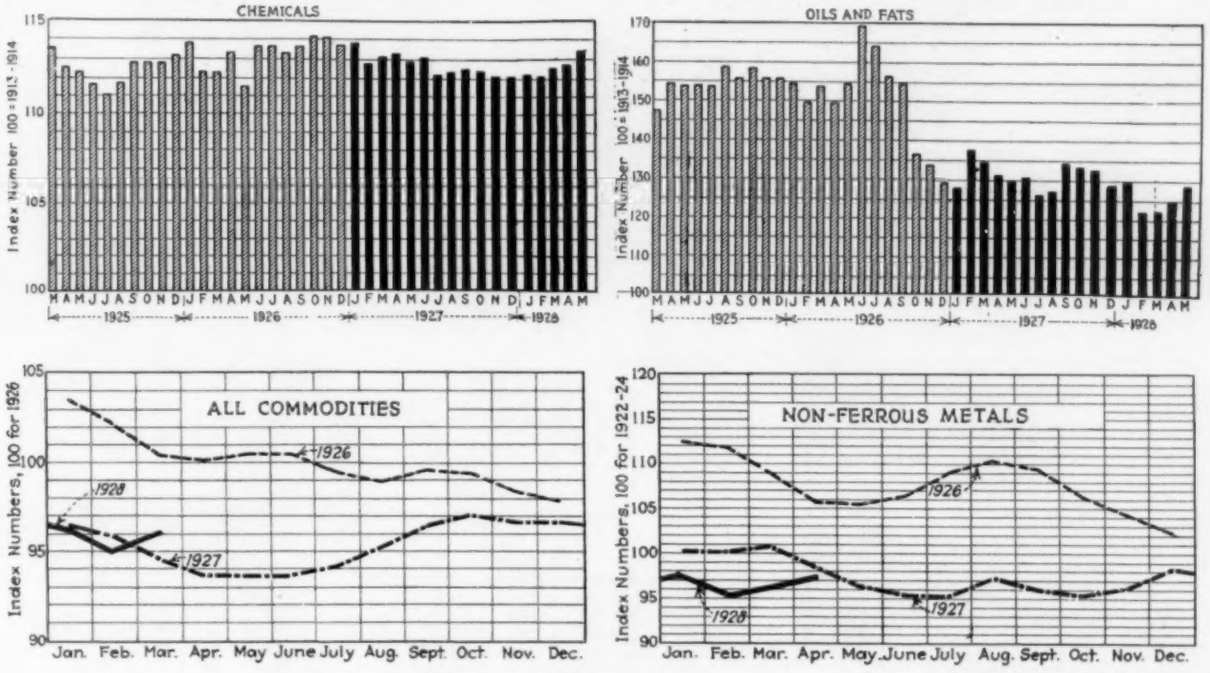
Oils and fats have been unsettled during the period because of unfavorable weather conditions in the cotton and grain-producing states. The market probably will be a weather proposition for the next month or longer.

Factory Production of Oils and Fats

THE Department of Commerce announces that the factory production of fats and oils, exclusive of refined oil and derivatives, during the three-month period ended March 31, 1928, was as follows: Vegetable oils, 789,210,195 lb.; fish oils, 8,939,097 lb.; animal fats, 718,879,608 lb.; and greases, 106,458,650 lb.; a total of 1,623,487,550 lb. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 612,931,016 lb., appears for lard. Next in order is cottonseed oil with 434,067,525 lb.; linseed oil with 223,750,569 lb.; tallow with 104,196,483 lb.; coconut oil with 75,934,932 lb.; and corn oil with 33,552,495 lb.

The production of refined oils during the period was as follows: Cottonseed, 406,457,026 lb.; coconut, 74,534,522 lb.; peanut, 2,406,030 lb.; corn, 28,798,330 lb.; soya-bean, 2,033,794 lb.; and palm-kernel, 3,693,306 lb. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

CHEM. & MET. *Weighted Indexes of* PRICES



U. S. Dep't of Labor — *Engineering & Mining Journal*

Irregular Price Tendencies in the Market for Chemicals

FLUCTUATIONS in asking prices for chemicals were numerous throughout the last month. Numerous selections were offered at reduced levels but higher prices prevailed for some of the more important chemicals and the weighted index number moved upward. The irregularity in prices may be traced to a similar condition in consuming trades part of which is accounted for on seasonal grounds. Fertilizer chemicals have been unusually active and strong markets exist for sulphur, sulphuric acid, nitrate of soda, and sulphate of ammonia.

All ammonia products are in a strong position because producers are well sold ahead and this condition is not expected to change materially over the remainder of the year with future prices fluctuations depending largely on the extent of consuming demand. Alcohol is higher for later deliveries and the market has been stabilized by the absence of resale offerings.

Quiet demand from the glass and paper trades has given a weak tone to the market for salt cake and niter cake and bleacking powder also is reported to be in plentiful supply. Other chemicals which move more slowly in the hot weather period are beginning to feel the seasonal influence and this generally presages a softening of asking prices.

Tariff developments have had some influence on prices in the way of strengthening barium carbonate because of higher import duty which has been ordered. Larger domestic production of barium carbonate in turn brought about surphur stocks of sodium sulphide and the latter has sold off sharply. Other commodities which may be affected by future tariff changes include glue, potassium nitrate, permanganate of potash and possibly sulphate of ammonia and methanol.

Alkalies and mineral acids are holding a steady price course and appear to be well established at current levels. Reports that foreign producers of potash contemplated an advance in price have been authoritatively denied.

WEATHER conditions have played the most important part in influencing values for vegetable oils and fats in the last month. Prices for grains moved up sharply as a result of unfavorable weather in the West and Northwest and hogs, lard, and other fats moved in sympathy with the grain markets. Weather conditions in the grain-producing states undoubtedly will continue as the most important market factor for some time to come with opinion inclining to the belief that higher prices are in prospect.

Values for cottonseed oil not only were strengthened by the rise in quotations for lard and fats but were likewise affected by reports that a large part of the growing cotton crop had been ruined. This was interpreted as an indication of a smaller yield of cottonseed and a consequent reduction in oil production in 1928-29. The smaller prospective oil production for next season served to eliminate the bearish influence of the large carryover this year. Other vegetable oils followed the lead of cottonseed oil except linseed and China wood oils which are non-competitive.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**113.20**
Last month	112.72
May, 1927	112.95
May, 1926	111.64

While there were several reductions in prices for chemicals during the month including formaldehyde, salt cake, tin salts, and fluoride of soda, the weighted index number was higher under the influence of strong markets for basic chemicals including sulphate of ammonia, acids, and copper sulphate.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**128.38**
Last month	124.90
May, 1927	129.97
May, 1926	154.49

The trend of values for oils and fats was upward during the period. Weather conditions adverse to growing crops had a strengthening effect on prices for cottonseed oil, lard, tallow, etc. Linseed oil also was higher and under the leadership of cottonseed oil the different vegetable oils were at higher levels.

CURRENT PRICES *in the* NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to May 14.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.13 -$0.14	$0.13 -$0.14	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.38 - 3.63	3.38 - 3.63	3.38 - 3.63
Boric, bbl.	lb.	.08½- .08½	.08½- .08½	.08½- .08½
Citric, kegs	lb.	.46 - .47	.46 - .47	.43½ - .45
Formic, bbl.	lb.	.11 - .12	.11 - .12	.10½ - .11
Gallic, tech., bbl.	lb.	.50 - .55	.50 - .55	.50 - .55
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.13 - .14	.13 - .14	.13½ - .14
22%, tech., light, bbl.	lb.	.06 - .07	.06 - .07	.06½ - .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.11 - .11½
Phosphoric, tech., c'bys.	lb.	.08½- .09	.08½- .09	.08½- .09
Sulphuric, 60°, tanks	ton	11.00 -11.50	11.00 -11.50	10.50 -11.00
Tannic, tech., bbl.	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl.	lb.	.38 - .38½	.38 - .38½	.33 - .34
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p.f., bbl.	gal.	2.70½- 2.75	2.70½- 2.75	4.85 - 4.90
Alcohol, Butyl, dr.	lb.	.18½- .19	.19 - .20	.20 - .20½
Denatured, 190 proof No. 1 special dr.	gal.	.44 -	.43 -	.40 -
No. 5, 188 proof, dr.	gal.	.43 -	.43 -	.40 -
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl.	lb.	.05½- .05½	.05½- .05½	.05½- .06
Potash, lump, bbl.	lb.	.02½- .03½	.02½- .03½	.02½- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums	lb.	.03 - .04	.03 - .04	.02½- .03
Ammonia, anhydrous, cyl.	lb.	.13½-	.13½-	.11 - .13
Ammonium carbonate, powd. tech., casks	lb.	.10½- .14	.10½- .14	.10½- .14
Sulphate, wks.	cwt.	2.70 -	2.60 -	2.45 -
Amylacetate tech., drums	gal.	1.75 - 2.00	1.75 - 2.00	2.15 - 2.20
Antimony Oxide, bbl.	lb.	.13½- .15	.13½- .15	.16½- .17
Arsenic, white, powd., bbl.	lb.	.04 - .04½	.04 - .04½	.03½- .04½
Red, powd., kegs	lb.	.09 - .10	.09½- .10	.10½- .11
Barium carbonate, bbl.	ton	57.50 -60.00	48.00 -50.00	47.00 -50.00
Chloride, bbl.	ton	55.00 -58.00	55.00 -	57.00 -
Nitrate, casks	lb.	.07½- .08	.08 - .08½	.07½- .08
Blanc fixe, dry, bbl.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.04 - .04½	.04 - .04½	.04½- .04½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	3.50 -	3.50 -	3.50 -
Arsenate, dr.	lb.	.06½- .07	.06½- .07	.06½- .07
Carbide drums	lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks.	ton	20.00 -	20.00 -	21.00 -
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05 - .06	.05½- .06	.05½- .06
Tetrachloride drums	lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.03½- .04½	.03½- .04½	.04 - .04½
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	16.00 -17.00	16.00- 17.00	15.00 -16.00
Copper carbonate, bbl.	lb.	.16½- .17½	.17 - .18	.17 - .18
Cyanide, tech., bbl.	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	5.15 - 5.20	5.05 - 5.10	4.80 - 4.90
Cream of tartar, bbl.	lb	.26½- .27	.25½- .26	.22 - .23
Diethylene glycol, dr.	lb.	.10 - .15	.10 - .15	- -
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.74 - .76	.74 - .76	.74 - .76
Formaldehyde, 40%, bbl.	lb.	.08 - .08½	.08½- .11½	.11½- .11½
Furfural, dr.	lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1.30 - 1.40	1.30 - 1.40	1.40 - 1.50
Refined, dr.	gal.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.10 - 1.20	1.00 - 1.10	1.00 - 1.10
Glycerine, e.p., drums, extra.	lb.	.15 - 15½	.15 - .15½	26 -
Lead: White, basic carbonate, dry, casks	lb.	.08½-	.08½-	.09½-
White, basic sulphate, sck.	lb.	.07½-	.07½-	.09½-
Red, dry, sck	lb.	.09½-	.09½-	.10½-
Lead acetate, white crys., bbl.	lb.	.13 - 13½	.13 - .13½	.14½-
Lead arsenate, powd., bbl.	lb.	.13 - .14	.12 - .13	.14 - .15
Lime, chem., bulk	ton	8.50 -	8.50 -	8.50 -
Litharge, pwd., csk.	lb.	.08½-	.08½-	.10 -
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags	lb.	.06½- .07	.07½- .08	.07½- .08
Methanol, 95%, dr.	gal.	.43 - .45	.43 - .45	.83 - .85
97%, dr.	gal.	.45 - .47	.45 - .47	.85 - .87
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.10 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10½- .11½
Orange mineral, csk.	lb.	$0.11½-	$0.11½-	$0.12½-
Phosphorus, red, cases	lb.	.62 - .65	.62 - .65	.62 - .65
Yellow, cases	lb.	.32 - .33	.32 - .34	.32 - .33
Potassium bichromate, casks	lb.	.08½- .08½	.08½- .08½	.08½- .08½
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.05½- .06	.05½- .06
Chlorate, powd.	lb.	.08½- .09	.08½- .09	.08½- .09
Cyanide, cs.	lb.	.55 - .57	.55 - .58	.55 - .57
First sorts, csk.	lb.	.09 - .09½	.08½- .09	.08½- .09
Hydroxide(c'stic potash)	dr. lb.	.07½- .07½	.07½- .07½	.07½- .07½
Muriate, 80% bgs.	ton	36.40 -	36.40 -	36.40 -
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums	lb.	.15 - .16	.15 - .16	.14 - .15
Prussiate, yellow, casks	lb.	.17½- .19	.18 - .19	.18½- .19
Sal ammoniac, white, casks	lb.	.047- .05	.047- .05	.05½- .06
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk	ton	14.00 -17.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32 -	1.32 -	1.32½-
Dense, bags	cwt.	1.35 -	1.35 -	1.37½-
Soda, caustic, 76%, solid, drums, contract	cwt.	2.80 - 3.00	2.80 - 3.00	3.00 - 3.10
Acetate, works, bbl.	lb.	.05½- .06	.05½- .06½	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.07 - .07½	.06½- .06½	.06½- .06½
Bisulphate, bulk	ton	3.00 - 3.50	5.00 - 5.50	5.00 - 5.50
Bisulphite, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chlorate, kegs	lb.	.05½- .06	.05½- .06	.06½- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.18 - .22
Fluoride, bbl.	lb.	.08½- .09½	.09 - .09½	.09½- .10
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Nitrate, bags	cwt	2.35 -	2.35 -	2.65 -
Nitrite, casks	lb.	.07½- .08	.07½- .08	.08 - .08½
Phosphate, dibasic, bbl.	lb.	.03 - .03½	.03½- .03½	.03½- .03½
Prussiate, yel. drums	lb.	.11½- .12	.12 - .12½	.12 - .12½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.02½- .03½	.03½- .04	.03½- .04
Sulphite, crys., bbl.	lb.	.02½- .03	.03 - .03½	.02½- .03
Strontium nitrate, bbl.	lb.	.09 - .09½	.08½- .09	.08½- .09
Sulphur, crude at mine, bulk	ton	18.00 -	18.00 -	18.00 -
Chloride, dr.	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.70 - 3.00
Tin bichloride, bbl.	lb.	.15½-	15½-	19½-
Oxide, bbl.	lb.	.56 -	56 -	70 -
Crystals, bbl.	lb.	.38½-	39 -	47 -
Zinc chloride, gran., bbl.	lb.	.06½- .06½	.06½- .06½	.06½- .06½
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10½- .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.09 - .10	.09 - .10	.10½- .11
Zinc oxide, lead free, bag.	lb.	.06½-	.06½-	.06½-
5% lead sulphate, bags	lb.	.06½-	.06½-	.06½-
Sulphate, bbl	cwt.	2.75 - 3.00	2.75 - 3.00	3.00 - 3.10

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.13½-$0.14	$0.13½-$0.14	$0.13½-$0.14
Chinawood oil, bbl.	lb.	.14½-	.15½-	.25 -
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-	.08½-	.08½-
Corn oil crude, tanks, (f.o.b. mill)	lb.	-	.09½-	.07½-
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½-	.07½-	.07½-
Linseed oil, raw, car lots, bbl.	lb.	.102-	.096-	.112-
Palm, Lagos, casks	lb.	.08 -	.07½-	.07½-
Niger, casks	lb.	.07½-	.07½- .07½	.07½-
Palm Kernel, bbl.	lb.	.09 -	.09½-	.09 -
Peanut oil, crude, tanks(mill)	lb.	.09½-	.09½-	.12 -
Perilla, bbl.	lb.	-	-	-
Rapeseed oil, refined, bbl.	gal.	.90 - .92	.85 - .86	.80 - .82
Sesame, bbl.	lb.	-	-	-
Soya bean tank (f.o.b. Coast)	lb.	.09½-	.09½-	.10 -
Sulphur(olive foots), bbl.	lb.	.09½-	.09½-	.09½-
Cod, Newfoundland, bbl.	gal.	.68 - .69	.66 - .67	.63 - .65
Menhaden, light pressed, bbl.	gal.	.60 - .66	.60 - .62	.60 - .62
Crude, tanks(f.o.b. factory)	gal.	.40 -	.40 -	.45 -
Whale, crude, tanks	lb.	-	-	-
Grease, yellow, loose	lb.	.07½-	.06½-	.06½-
Oleo stearine	lb.	.11½-	.11½-	.09½-
Red oil, distilled, d.p. bbl.	lb.	.09½- .09½	.09½- .09½	.09½- .10
Tallow, extra, loose	lb.	.08½-	.08½-	.07½-

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl.	lb.	.85 - .90	.85 - .90	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.15 - .16	.15 - .16	.15 - .16
Aniline salts, bbl	lb.	.24 - .25	.24 - .25	.24 - .25
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

		Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Bensidine base, bbl.	lb.	.70 - .72	.70 - .75	.70 - .72
Benzoic acid, U.S.P., kgs.	lb.	.58 - .60	.58 - .60	.58 - .60
Benzyl chloride, tech, dr.	lb.	.25 - .26	.25 - .26	.23 - .24
Bensol, 90%, tanks, works	gal.	.22 - .23	.21 - .22	.24 - .25
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr.	lb.	.18 - .20	.18 - .20	.18 - .20
Cresylic acid, 97%, dr., wks	gal.	.73 - .75	.73 - .75	.61 - .62
Diethylaniline, dr.	lb.	.58 - .60	.58 - .60	.58 - .60
Dinitrophenol, bbl.	lb.	.31 - .35	.31 - .33	.31 - .35
Dinitrotoluen, bbl.	lb.	.17 - .18	.17 - .18	.17 - .18
Dip oil, 25% dr.	gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl.	lb.	.45 - .47	.45 - .47	.45 - .47
H-acid, bbl.	lb.	.63 - .65	.63 - .65	.63 - .65
Naphthalene, flake, bbl.	lb.	.05 - .06	.04½ - .05	.05½ - .06
Nitrobenzene, dr.	lb.	.08½ - .10	.09 - .10	.09 - .10
Para-nitraniline, bbl.	lb.	.52 - .53	.52 - .53	.50 - .53
Para-nitrotoluine, bbl.	lb.	.28 - .32	.28 - .32	.40 - .42
Phenol, U.S.P., drums	lb.	.17 - .18	.18 - .19	.17 - .18
Picric acid, bbl.	lb.	.30 - .40	.30 - .40	.25 - .26
Pyridine, dr.	lb.	3.00 -	3.00 -	3.90 - 4.00
R-salt, bbl.	lb.	.47 - .50	.47 - .50	.47 - .50
Resorcinal, tech, kegs.	lb.	1.30 - 1.35	1.35 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl.	lb.	.30 - .32	.30 - .32	.30 - .32
Solvent naphtha, w.w.,tanks	gal.	.35 -	.35 -	.35 - .....
Tolidine, bbl.	lb.	.95 - .95	.95 - .96	.90 - .95
Toluene, tanks, works	gal.	.35 -	.35 -	.35 - .....
Xylene, com., tanks	gal.	.36 - .41	.36 - .41	.36 - .40

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl.	ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl.	lb.	.16 - .18	.16 - .18	.15 - .16
China clay, dom.,f.o.b. mine	ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.06½ - .07	.06½ - .07	.08 - .08½
Prussian blue, bbl.	lb.	.31 - .33	.31 - .33	.33 - .34
Ultramine blue, bbl.	lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl.	lb.	.27 - .31	.27 - .30	.27 - .30
Carmine red, tins	lb.	5.50 - 5.75	5.50 - 5.75	5.00 - 5.10
Para toner	lb.	.70 - .80	.70 - .80	.80 - .90
Vermilion, English, bbl.	lb.	1.80 - 1.85	1.80 - 1.85	1.45 - 1.50
Chrome yellow, C. P., bbl.	lb.	.17 - .18	.17 - .18	.17½ - .18
Feldspar, No. 1 (f.o.b. N. C.)	ton	5.75 - 7.00	5.75 - 7.00	6.00 - 6.50
Graphite, Ceylon, lump, bbl.	lb.	.07½ - .08	.07½ - .09½	.08 - .09
Gum copal, Congo, bags.	lb.	.07½ - .08	.07½ - .08	.09½ - .10
Manila, bags	lb.	.15 - .18	.15 - .16	.15 - .18
Damar, Batavia, cases	lb.	.23 - .24	.23 - .24	.25 - .25
Kauri, No. 1 cases	lb.	.48 - .53	.48 - .53	.55 - .57
Kieselguhr (f.o.b. N. Y.)	ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.	ton	44.00 -	44.00 -	44.00 - .....
Pumice stone, lump, bbl.	lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks	lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H.	bbl.	9.00 -	9.90 -	10.85 - .....
Turpentine	gal.	.53½ -	.58 -	.62 - .....
Shellac, orange, fine, bags	lb.	.51 - .52	.51 - .52	.38 - .39
Bleached, bonedry, bags	lb.	.54 - .56	.54 - .56	.47 - .50
T. N. bags	lb.	.45 - .46	.44 - .45	.37 - .38
Soapstone (f.o.b. Vt.), bags	ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.)	ton	10.50 -	10.50 -	11.00 - .....
300 mesh (f.o.b. Ga.)	ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.)	ton	13.75 -	13.75 -	14.75 - .....

		Current Price	Last Month	Last Year
Wax, Bayberry, bbl.	lb.	$0.32 -$0.33	$0 23½-$0.26	$0.25 -$0 26
Beeswax, ref., light	lb.	.43 - .45	.43 - .47	.45 - .46
Candelilla, bags	lb.	.23½ - .24	.25 - .27	.33 - .34
Carnauba, No. 1, bags	lb.	.55 - .56	.54 - .55	.65 - .70
Paraffine, crude 105-110 m.p.	lb.	.04½ - .05	.04½ - .05	.05½ - .06

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00-	$200.00-	$200.00- .....
Ferromanganese, 78-82%	ton	100.00-	100.00-	100 00-90.00
Spiegeleisen, 19-21%	ton	31.00-32 00	31.00-32 00	36 00-37.00
Ferrosilicon, 10-12%	ton	33.00-38.00	33.00-38 00	33.00-38.00
Ferrotungsten, 70-80%	lb.	.92- .95	.90- .95	.98- 1.05
Ferro-uranium, 35-50%	lb.	4.50-	4.50-	4.50- .....
Ferrovanadium, 30-40%	lb.	3.15- 3.75	3.15- 3.75	3.15- 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic	lb.	$0.14½-	$0.14½ -	$0.13 - .....
Aluminum, 96-99%	lb.	.24 - .26	.24 - .26	.26 - .28
Antimony, Chin. and Jap.	lb.	.11 - .11½	.10 - .11	.13½ - .15
Nickel, 99%	lb.	.33 -	.33 -	.35 - .....
Monel metal, blocks	lb.	.32 - .33	.32 - .33	.32 - .33
Tin, 5-ton lots, Straits	lb.	.52 -	.51½ -	.68 - .....
Lead, New York, spot	lb.	6.10 -	6.10 -	7.15 - .....
Zinc, New York, spot	lb.	6.35 -	6.05 -	6.72 - .....
Silver, commercial	oz.	.57½ -	.57½ -	.56½ - .....
Cadmium	lb.	.60 -	.60 -	.60 - .....
Bismuth, ton lots	lb.	1.85 - 2.10	1.85 - 2.00	2.20 - 2.25
Cobalt	lb.	2.50 -	2.50 -	2.50 - .....
Magnesium, ingots, 99%	lb.	.75 - .80	.75 - .80	.75 - .80
Platinum, ref.	oz.	85.00-	85.00-	108.00- .....
Palladium, ref.	oz.	50.00- 52.00	50.00- 52.00	59.00-63.00
Mercury, flask	75 lb.	123.50-	124.50-	126.00- .....
Tungsten powder	lb.	1.05- 1.15	1.05-	1.05- .....

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$5.50- $8.50	$5.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post	ton	22.00- 24.00	22.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens	ton	2.85- 3.00	2.85- 3.00	3.25- 3.75
Fluorspar, gravel, f.o.b. Ill.	ton	14.50-	14.50-	18.00 .....
Ilmenite, 52% TiO_2, Va.	lb.	.00½ - .00½	.00½- .00½	.00½ - .....
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.36 - .38	.36 - .38	.36 - 38
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.48 - .50	.48 - .50	48 - .50
Monazite, 6% of ThO_2	ton	120.00-	120.00-	120.00- .....
Pyrites, Span. fines, c.i.f.	unit	.13½-	.13½-	.13½- .....
Rutile, 94-96% TiO_2	lb.	.11 - .13	.11 - .13	.11 - .13
Tungsten, scheelite, 60% WO_3 and over	unit	10.50 -10.75	10.50 -10.75	11.25 -11.50
Vanadium ore, per lb. V_2O_5	lb.	.25 - .28	.25 - .30	.25 - .28
Zircon, 99%	lb.	.03 -	.03 -	.03 - .....

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Asbestos Products Factory—H. W. Johns-Manville Co., Inc., of California, 159 New Montgomery St., San Francisco, Calif., is having plans prepared for two 1 story, 100 x 500 ft. factory buildings for the manufacture of asbestos products, roofing, etc., at Pittsburg, Calif. Estimated cost $1,000,000. H. J. Brunnier, Sharon Bldg., San Francisco, Calif., is engineer.

Asphalt Roofing Factory — Brantford Roofing Co., Brantford, Ont., plans the construction of a plant for the production of asphalt roofing and shingles at St. John, N. B. Estimated cost $150,000.

Bottling Plant—Coca Cola Bottling Co., Poplar Bluffs, Mo., awarded contract for the construction of a bottling plant to Greer & Schach, Poplar Bluffs, Mo. Estimated cost $40,000.

Brewing House Addition — John Labatt Ltd., W. E. Burke, Mgr., Simcoe St., London, Ont., awarded contract for addition to brewing house to John Hayman & Sons, 432 Wellington St., London, Ont. Estimated cost $50,000. Equipment including special vats, copper kettles, mash tanks, etc., will be installed.

Brick Plant—Missouri Insulating & Refractories Corp., c/o Industrial Bureau St. Louis Chamber of Commerce, 511 Locust St., St. Louis, Mo., is having preliminary plans prepared for the construction of a plant for the manufacture of insulating refractory products including light weight insulating brick on Clayton Rd., Cayton, Mo. Estimated cost $1,000,000.

Brick Manufacturing Plant—D. W. Watkins Co. Inc., Pine St., Providence, R. I., will soon award contract for a 2 story, 40 x 95 ft., brick manufacturing plant. Estimated cost $45,000. W. R. Walker & Son, 49 Weybosset St., Providence, R. I., are architects.

Equipment Wanted for New Cellulose Acetate Plant

The Viscose Company will erect a large factory at Meadville, Pa., for cellulose acetate rayon yarn. The equipment required will include a complete plant for the manufacture of Acetic Anhydride, including Drying Equipment for Sodium Acetate, Decomposers, Stills, Copper Columns, Condensers and other similar equipment. They will also require Hydraulic Filter Presses, Pumps for High Viscosity Liquid, Glass Enameled Vessels, Heavy Cast Iron Vessels, Acid-Resisting Bronze Cocks, Valves and Fittings and Tin-Lined Steel Vessels.

Manufacturers are particularly requested not to send representatives to call personally in connection with the above project, but correspondence directed to J. L. Shade, Purchasing Agent, The Viscose Company, Marcus Hook, Pa., will receive careful consideration, and appointments will be made with manufacturers capable of supplying the necessary equipment, for their representatives to call and submit the proposals in detail.

Cake and Cotton Seed Oil Equipment — Corrugated Cattle Cake & Cotton Seed Oil Co, Milton, Ont., plans the installation of complete equipment for handling cake and cotton seed oil for recently acquired plant. Estimated cost $50,000.

Candy Factory—C. A. Asher, 5606 Germantown St., Philadelphia, Pa., awarded contract for a 4 story, 51 x 52 ft. candy factory to William Steele & Sons Co., 15th and Cherry Sts., Philadelphia, Pa. Estimated cost $65,000.

Candy Factory — Brown Candy & Cracker Co., 810 South Medina St., San Antonio, Tex., plans the construction of a 3 story candy and cracker factory. Estimated cost $350,000. Private plans. Equipment including five large ovens, etc., will be required.

Cannery—California Co-Operative Producers, California Life Bldg., Sacramento, Calif., awarded contract for several 1 story cannery buildings at 7th St. and American River to Sacramento Industrial Corp., Sacramento, Calif. Estimated cost $250,000.

Canning Plant—Dominion Canners Ltd., Kelowna, B. C., plans the construction of a canning plant. Estimated cost $150,000.

Canning Plant—W. C. High, Ardmore, Okla., is having plans prepared for a 1 story, 50 x 100 ft. tomato canning plant at Thackerville, Okla., for Southern Oklahoma Canning Co. Estimated cost $50,000. Private plans. Equipment will be required.

Canning Plant — Ozark Canning Co., Tulsa, Okla., is having plans prepared for a 1 story, 50 x 120 ft. tomato canning plant on Fifth St. Estimated cost $60,-

000. Private plans. Equipment will be required.

Celite Products Factory—Celite Products Co., Lompoc, Calif., has acquired the National Magnesia Co.'s plant at Redwood City, Calif. and plans to expend $200,000 in plant additions and equipment.

Cement Plant—Carolina Cement Co., New Bern, N. C., R. C. Clark, Raleigh, Secy. & Treas., plans the construction of a plant for the manufacture of portland cement from native marl. Estimated cost $3,000,000.

Cement Plant—Portland Cement Corp., L. L. Griffiths, Pres., Ann Arbor, Mich., plans the construction of a cement mill at Pownal, Vt. Estimated cost $1,000,000.

Cereal Manufacturing Plant — Quaker Oats Co., 80 East Jackson Blvd., Chicago, Ill., awarded contract for the construction of a cereal manufacturing plant at St. Joseph, Mo. to Leonard Construction Co., 37 South Wabash St., Chicago, Ill. Estimated cost $3,000,000.

Chemistry Building—Purdue University, Lafayette, Ind., is having plans prepared for a chemistry building. Estimated cost $300,000. W. Scholer, 301 Painters Bldg., Lafayette, Ind., is architect.

Chemistry Building — Texas Technical College, c/o A. P. Horn, Pres., Lubbock, Tex., awarded contract for a 2 story, 106 x 233 ft. chemistry building to D. N. Leaverton, Lubbock, Tex. Estimated cost $240,000.

Clay Products Plant—American Vitrified Product Co., 16 Broad St., Akron, O., plans to rebuild 1 story factory at Toronto, O., recently destroyed by fire. Estimated cost $100,000.

Clay Working Plant—Niloak Pottery Co., Benton, Ark., plans the construction of a 1 story clay working plant. Estimated cost $40,000. H. R. Burke, Homes Bldg., Little Rock, Ark., is architect.

Coke Handling System—The Woodward Iron Co., Woodward, Ala., awarded contract for the construction of a complete new coke handling system including wharf, screening and loading plant, etc., to Semet-Solvay Engineering Co., 61 Broadway, New York, N. Y.

Coke Ovens — New England Fuel & Transportation Co., 250 Stuart St., Boston, Mass., plans the construction of two coke ovens on Rover St., Everett, Mass. Private plans.

Compressed Gas Plants — Presto-O-Lite Co. and Linde Air Products Co., subsidiaries of the Union Carbide & Carbon Co., 30 East 42nd St., New York, N. Y., are having plans prepared for compressed gas plants at Jacksonville, Fla. Estimated total cost $150,000. Private plans.

Cotton Compress Plant—Underwood Compress Co., Hollis, Okla., plans the construction of a 225 x 600 ft. cotton compress plant. Estimated cost $150,000. Private plans.

Cracking Plant—Motor Fuel Co., Laredo, Tex., awarded contract for the construction of a cracking plant for the manufacture of domestic and anti-knock gasoline, to Graver Corp., 4809 Todd Ave., East Chicago, Ind.

Drug Factory—Ex-Lax Mfg. Co., 431 Atlantic Ave., Brooklyn, N. Y., awarded contract for the construction of a drug factory at 433 Atlantic Ave., to S. Glicksman, 1158 East 8th St., Brooklyn, N. Y.

Drug Manufacturing Plant — Schieffelin & Co., 170 William St., New York, N. Y., awarded contract for a 7 story drug manufacturing plant at 16-26 Cooper Sq., to W. Young Co., 414 West 41st St., New York, N. Y. Estimated cost $40,000.

Gas Plant—Intercontinent Gas Co., M. W. Ditto, 11 Broadway, New York, N. Y., is having preliminary plans prepared for a gas plant at Lamoor, Va. to supply gas to Covington and Clifton Forge, Va. Estimated cost approximately $10,000,000.

Gas Plant Addition—Petersburg Gas Co., c/o Stevens & Wood, 120 Broadway, New York, N. Y., Contrs., awarded contract for addition to gas plant at Petersburg, Va. Estimated cost $50,000.

Gold Leaf Factory—Mychreest & Reynolds, 238 Palm St., Hartford, Conn., Archt., will receive bids until May 21 for a 2 story, 55 x 200 ft. gold leaf factory for M. Swift & Sons, 100 Love Lane, Hartford, Conn. Estimated cost $100,000.

Gypsum Factory—U. S. Gypsum Co., 205 West Monroe St., Chicago, Ill., awarded contract for a gypsum factory, including silos, docks, etc., at Charlestown, Mass. Estimated cost $2,000,000, also has plans under way for plants at Philadelphia, Pa., Chicago, Ill. and Detroit, Mich.

Laboratory—Bd. of Trustees, Miami University, Columbus, O., J. M. Withrow, 22 West Seventh St., Cincinnati, O., will receive bids until May 22 for the construction of a laboratory at Oxford, O. Estimated cost $60,000. H. B. Briggs, Ohio-Hartman Bldg., Columbus, O., is architect.

Laboratory — St. Mary's School, Lancaster, O., awarded contract for a 3 story, 120 x 246 ft. high school and community center, including laboratory, etc., to W. A. Shower & Co., Crooksville, O. Estimated cost $150,000.

Laboratory—University of Tennessee, T. L. Morris, Secy., Knoxville, Tenn., will soon award contract for the construction of a laboratory. Estimated cost $200,000. Barber & McMuny, General Bldg., Knoxville, Tenn., are architects.

Laboratory—Y. M. C. A., c/o R. Lewis, Secy., East 22nd St. and Prospect Ave., Cleveland, O., will soon award contract for a 4 story, 50 x 120 ft. laboratory. Estimated cost $175,000. Hubbell & Benes Co., 4500 Euclid Ave., Cleveland, O., is architect.

Laboratory (Chemical) — Amherst College, Amherst, Mass., awarded contract for the construction of a chemical laboratory to Casper Construction Co., Holyoke, Mass. Estimated cost $1,000,000.

Laboratory (Chemical)—Grasselli Chemical Co., Guardian Bldg., Cleveland, O., awarded contract for a 2 story, 32 x 56 ft. chemical laboratory at 3200 Broadway, to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $40,000.

Laboratory (Occupational Therapy) — Bergen County Hospital, Peramus, N. J., is having sketches made for a 1 story occupational therapy laboratory at Ridgewood, N. J. Estimated cost $40,000. C. V. R. Bogert, 210 Main St., Hackensack, N. J., is architect.

Laboratory (Research)—A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt., will receive bids about May 21 for a 7 story, 210 x 230 ft. research laboratory for General Motors Corp., General Motors Bldg., Detroit, Mich.

Laboratory (Testing)—J. M. White, Administration Bldg., Urbana, Ill., Sup. Archt. and Engr., will receive bids until May 19 for a 3 story testing laboratory, etc., for University of Illinois, Urbana, Ill. Estimated cost $1,000,000.

Laboratories, Etc.—Dominican College of St. Thomas Aquinas, Oak Park, Ill., is having preliminary plans prepared for a 150 x 366 ft. high school including laboratories, etc. at Scoville and East Aves. Estimated cost $1,000,000.

Laboratories, (Testing), Etc.—Crane Co., 826 South Michigan Ave., Chicago, Ill., had plans prepared for a 3 story, 82 x 502 ft. addition to factory for testing laboratories, etc. at 4100 South Kedzie Ave. Graham, Anderson, Probst & White, 80 East Jackson Blvd., Chicago, Ill., are architects.

Leather Factory—England Walton Co., Inc., 3rd and Vine Sts., Philadelphia, Pa., awarded contract for a 7 story, 41 x 63 ft. leather factory to William Steele & Sons Co., 121 North 15th St., Philadelphia, Pa. Estimated cost $60,000.

Malting Plant — Canada Malting Co., Royal Bank Bldg., Toronto, Ont., awarded contract for excavation, etc., for a 2 story malting plant and grain elevator. Estimated cost $500,000.

Nickel Plating Factory—Chrysler Motor Car Co., Massachusetts Ave., Highland Park, Mich., awarded contract for a 1 story addition to factory for nickel plating department to Everett Winters, 1651 East Grand Blvd., Detroit, Mich. Estimated cost $50,000. Equipment will be installed.

Oxygen Plant — Magnolia Gas Products Co., W. A. Sherman, Pres., 506 South Medina St., San Antonio, Tex., awarded contract for the construction of a 1 story, 50 x 120 ft. oxygen plant, to Maclay Construction Co., Houston, Tex. Estimated cost $60,000.

Paper Mill—Stone & Forsythe Co., 67 Kingston St., Boston, Mass., awarded contract for a 2 story addition to paper mill at Everett, Mass., to Blake & Pope Co., 38 Chauncy St., Boston. Estimated cost $40,000.

Phonograph Record Department, Etc.—Brunswick-Balke-Collendar Co., 855 South Los Angeles St., Los Angeles, Calif., awarded contract for a 1 story factory including 115 x 177 ft. phonograph record manufacturing department, finishing and drying rooms, etc. at Mines Ave. and Calada St. to W. P. Neil Co., 4814 Loma Vista St., Los Angeles, Calif. Estimated cost $100,000.

Porcelain Factory—Carey Porcelain Co., W. D. Wooley, Pres. and Gen. Mgr., Carey, O., plans to rebuild porcelain factory recently destroyed by fire.

Pulp and Paper Mill—E. Z. Opener Bag Co., Decatur, Ill., plans the construction of a plant including 2 story, 110 x 280 ft. pulp and paper mill, 75 x 110 ft. beater building, 70 x 90 ft. digester building, etc., at Tuscaloosa, Ala.

Pulp and Paper Mill — Stevens Point Pulp & Paper Co., Stevens Point, Wis. plans the construction of a 2 story addition to pulp and paper mill at McDill, Wis. Private plans.

Pumicite Plant — Pumicite Co., Ambassador Bldg., St. Louis, Mo., will build pumicite plants at Stanley, Wilmore, Fowler and Meade, Kan. Estimated cost $30,000 each. Lee Heidenrich Engineering Co., 620 Central Exchange Bldg., Kansas City, Mo., is engineer.

Pyrofax Plant—Union Carbide & Carbon Co., 30 East 42nd St., New York, N. Y., will soon award contract for a 1 story pyrofax plant at Cambridge, Mass. Estimated cost $40,000. Private plans.

Refinery — Stilwell Benzol Refinery Co., c/o A. E. Stilwell, Port Arthur, Tex., plans the construction of a refinery, 1,000 bbl. capacity. Estimated cost $350,000. Architect not announced.

Refinery (Lubricating Oil)—Golden West Oil Co., National Bank of Commerce Bldg., San Antonio, Tex., plans the construction of a lubricating oil refinery. Private plans.

Refinery (Oil and Gas)—Bell Oil & Gas Co., Sweetwater, Tex., is having preliminary plans prepared for an oil and gas refinery. Estimated cost $100,000. Private plans.

Rubber Reclaiming Plant—Midwest Rubber Reclaiming Co., c/o Akron Rubber Reclaiming Co., Norton Ave., Akron, O., awarded contract for a 1 story rubber reclaiming plant, 25 ton daily capacity, at Monsanto Village near East St. Louis, Ill., to The Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $150,000.

Salt Factory—United Salt Corp., c/o J. M. Howe, Pres., First National Bank Bldg., Houston, Tex., plans the construction of a salt evaporating plant, 250 ton daily capacity. Estimated cost $500,000. Architect and engineer not announced.

Soap Factory—Iowa Soap Co., Burlington, Ia., awarded contract for a factory to A. Danielson & Son, Burlington, Ia. Estimated cost $100,000.

Soap Factory—Procter & Gamble Co., Gwynne Bldg., Cincinnati, O., plans the construction of a soap factory at Baltimore, Md. Estimated cost $3,500,000. H. Manley, 550 East 53rd St., New York, N. Y., is architect.

Spark Plug Factory—A. C. Spark Plug Co., Flint, Mich., awarded contract for a 3 story factory for addition to ceramic department on South Saginaw St., to W. E. Wood Co., 1805 Ford Bldg., Detroit, Mich. Estimated cost $40,000. Equipment will be required.

Sulphur Mining—Texas Gulf Sulphur Co. Inc., 41 East 42nd St., New York, N. Y., have acquired 120 acres of sulphur deposits near Wharton, Tex., will lay out town site, build spur tracks and install mining machinery, etc. Estimated cost $2,000,000 to $3,000,000. J. G. White Engineering Co., 43 Exchange Pl., New York, N. Y., is engineer. Some work will be done by day labor.

Tannery Equipment—John Miller, Orillia, Ont., wants prices and catalogs on complete equipment for tannery recently destroyed by fire.

Tiling Plant—American Encaustic Tiling Co., Maurer, N. J., is having plans prepared for a 1 story tiling plant. Estimated cost $40,000. Private plans.

Varnish Factory—Diamond Products Co., 703-711 South Third Ave., Marshalltown, Ia., plans the construction of a varnish factory, 2,000 gal. daily capacity.

Waterproofing Factory — Anti-Hydro Waterproofing Co., 265 Badger Ave., Newark, N. J., will soon award contract for a 3 story, 60 x 100 ft. waterproofing factory. Estimated cost $40,000. E. C. Epple, 9 Clinton St., Newark, N. J., is consulting engineer.

Wax Paper Factory—Waxide Paper Co., Berkowitz Ave., 20th and Tracy Sts., Kansas City, Mo., will soon receive bids for a 1 story, 150 x 267 ft. wax paper factory at St. Louis, Mo. Estimated cost $250,000. L. Haeger, 3844 Utah Pl., St. Louis, Mo., is architect.

Zinc Factory — United States Zinc Co., Amarillo, Tex., plans the construction of a zinc factory. Estimated cost $50,000.